

# **90-DAY REPORT OF MARINE MAMMAL MONITORING AND MITIGATION DURING A SHALLOW GEOHAZARD SURVEY BY HILCORP ALASKA IN FOGGY ISLAND BAY, ALASKA, JULY 2015**



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## Table of Contents

	<u>Page</u>
1.0 Introduction.....	1
2.0 2015 Hilcorp Survey Project Description .....	3
2.1 Project Details.....	3
2.1.1 Dates, Duration, and Region of Activity .....	9
2.1.2 Vessel and Equipment .....	9
2.1.3 Survey Design.....	10
3.0 Summary of Marine Mammals in Project Area .....	12
3.1 Bowhead Whale.....	12
3.2 Gray Whale.....	12
3.3 Beluga Whale.....	13
3.4 Ringed Seal .....	13
3.5 Spotted Seal .....	13
3.6 Bearded Seal .....	14
3.7 Polar Bear .....	14
4.0 Marine Mammal Monitoring and Mitigation Program Summary.....	15
4.1 Purpose .....	15
4.2 Mitigation Measures .....	15
4.2.1 General Mitigation Measures.....	15
4.2.2 Shallow Geohazard Survey Mitigation Measures.....	16
4.2.3 Mitigation Measures for Subsistence Activities .....	18
4.3 Monitoring Procedures .....	18
4.3.1 Vessel based Visual Monitoring .....	18
5.0 Marine Mammal Monitoring Analysis and Results.....	20
5.1 Marine Mammal Monitoring Data Analysis Methods.....	20
5.1.1 Classification of Data.....	20
5.1.2 Sighting Rates .....	21
5.1.3 Estimation Number of Exposures.....	23
5.2 Marine Mammal Monitoring Results.....	23
5.2.1 PSO Effort .....	23
5.2.2 Sightings .....	29
5.3 Mitigation Measures .....	36
5.4 Estimated Number of Marine Mammals Potentially Exposed.....	37
6.0 References Cited .....	39

**List of Tables**

Table 2-1	Equipment specifications .....	10
Table 4.2-1	Modeled safety zone radii distance (m) to received sound pressure levels (in dB re 1 $\mu$ Pa [rms]) based on existing modeling data. The observed ZOI was used from 9 July to 19 July.....	16
Table 5.2-1	Total effort on and off watch during the Hilcorp shallow geohazard survey, 9 July to 19 July 2015.....	24
Table 5.2-2	Total sightings during the Hilcorp shallow geohazard survey, 9 July to 19 July 2015.....	29
Table 5.2-3	Marine mammal movement in relation to the vessel and activity. ....	35
Table 5.2-4	Marine mammal behavior in relation to the vessel and activity.....	35
Table 5.2-5	Comparison of behavioral reactions in relation to the vessel and activity. ....	36
Table 5.2-6	The three shutdowns implemented for marine mammals.....	37
Table 5.5-1	Best estimates of the potential number of marine mammals exposed to sounds levels $\geq 160$ dB. ....	38

**List of Figures**

Figure 2-1	Project Area Boundary and Vessel Activity .....	5
Figure 2-2	Vessel Activity and Project Area.....	7
Figure 5.2-1	On-watch PSO observation effort (km) by survey and transit area (outside the project area boundary) during the Hilcorp shallow geohazard survey, 9 July to 19 July 2015.....	24
Figure 5.2-2	Usable PSO effort (km) by number of PSOs during the Hilcorp shallow geohazard survey, 9 July to 19 July 2015.....	25
Figure 5.2-3	Usable effort (km) by Beaufort sea state during the Hilcorp shallow geohazard survey, 9 July to 19 July 2015. ....	26
Figure 5.2-4	Usable PSO effort (km) by visibility distance during the Hilcorp shallow geohazard survey, 9 July to 19 July 2015. ....	27
Figure 5.2-5	Usable PSO effort (km) by percent ice cover within 2 km of vessel during the Hilcorp shallow geohazard survey, 9 July to 19 July 2015. ....	28
Figure 5.2-6	Tracklines and Marine Mammal Sightings.....	30
Figure 5.2-7	Marine mammal sighting rates by vessel activity during the Hilcorp shallow geohazard survey, 9 July to 19 July 2015.....	32
Figure 5.2-8	Sighting rates during Beaufort sea state conditions during the Hilcorp shallow geohazard survey, 9 July to 19 July 2015. The absence of a bar indicates no data were recorded for that category.....	33
Figure 5.2-9	Sighting rate by visibility distance (km) categories during the Hilcorp shallow geohazard survey, 9 July to 19 July 2015. The absence of a bar indicates no data were recorded for that category. No sightings occurred during periods of variable visibility. ....	34



**List of Appendices**

- Appendix A JASCO Passive Acoustic Monitoring Operations Plan
- Appendix B Permits: NMFS IHA and USFWS LOAs
- Appendix C Sighting Table
- Appendix D Vessel Specifications
- Appendix E Beaufort sea state Definitions

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## ABBREVIATIONS

4MP	Marine Mammal Monitoring and Mitigation Plan
AMAR	autonomous multichannel acoustic recorder
CFR	Code of Federal Regulations
CPA	closest point of approach
dB	decibel(s)
ESA	Endangered Species Act of 1973
FR	Federal Register
ft	feet/foot
h	hour
Hilcorp	Hilcorp Alaska, LLC
Hz	Hertz
IHA	Incidental Harassment Authorization
JASCO	JASCO Applied Sciences (Alaska), Inc.
kHz	kilohertz
km	kilometer(s)
km <sup>2</sup>	square kilometers
kts/hr	knots per hour
LOA	Letter of Authorization
m	meter(s)
mi	mile(s)
mi <sup>2</sup>	square miles
MMPA	Marine Mammal Protection Act of 1972
M/V	motor vessel
NMFS	National Marine Fisheries Service
POC	Plan of Cooperation
PSO	Protected Species Observer
re 1μPa	Relative to 1 micro Pascal
rms	root mean square
RSL	received sound levels
SDI	Endicott Satellite Drilling Island
U.S.	United States
U.S.C.	United States Code
USFWS	U.S. Fish and Wildlife Service
ZOI	Zone of influence

## CONVERSIONS

<b>Metric</b>	<b>Imperial</b>
1 m	3.281 ft
1 km	0.621 mi
1 km <sup>2</sup>	0.386 mi <sup>2</sup>

## 1.0 Introduction

In 2015, Hilcorp Alaska, LLC (Hilcorp) conducted a vessel based shallow geohazard and strudel scour survey (hereafter referred to as survey) with a transition zone component in United States (U.S.) federal and state waters of the Beaufort Sea. The survey mobilized 7 July, Protected Species Observer (PSO) observations were conducted 9 July through 19 July, and the project was fully demobilized 20 July 2015. This survey was to support development of the Liberty field located in federal waters in Foggy Island Bay, approximately 12.8 kilometers (km) (8 miles [mi]) east of the Endicott satellite drilling island (SDI). Data collected from the survey will be used to determine feasibility of building a gravel island over the Liberty reservoir and installing a subsea pipeline to transport sales quality crude oil to shore.

The survey evaluated the existence and location of archaeological resources, potential geologic hazards on the seafloor and in the shallow subsurface, and investigated the depth and distribution of ice gouges. The survey focused on the upper 1,000 meters (m) (3,280.8 feet [ft]) of the seabed. Sonar equipment used emitted low-level, very high to low frequency continuous acoustic sounds on limited areas of the ocean bottom and intermediate water column.

Hilcorp was permitted to conduct the survey within a 6.5 square kilometers (km<sup>2</sup>) (2.5 square miles [mi<sup>2</sup>]) area and included a total of 300 m (984 ft) of planned survey lines. Specifically, the proposed Liberty Island pipeline route, a 600 m (1,969 ft) wide corridor located 17 km (11 mi) southeast of Endicott extending to shore, was surveyed. The project vessel started sonar testing on 9 July and Hilcorp surveyed 729 km (452 mi), shown in Figure 2-1. Survey data acquisition occurred from 12 through 19 July.

The purpose of this 90-day report is to describe Hilcorp's 2015 survey activities in the Beaufort Sea; the marine mammal monitoring and mitigation methods implemented and their results; and provide an estimated number of marine mammals potentially exposed to harmful levels of sound generated by the survey activity.

The National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS) regulate activities which have potential for auditory and behavioral disturbances that result in a "take" under provisions of the Marine Mammal Protection Act of 1972 (MMPA) and the Endangered Species Act of 1973 (ESA).

NMFS issued Hilcorp an Incidental Harassment Authorization (IHA) on 29 June 2015 to allow for incidental take, by Level B harassment, of small numbers of whales and seals in conjunction with the survey. The MMPA defines Level B harassment as any activity that has potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering [16. United States Code (U.S.C.) 1362(18)(B)]. For this project, NMFS considers a take by harassment to occur when an animal is exposed to sound levels described in Section 5.0 Marine Mammal Monitoring Analysis and Results in this report. Similarly, USFWS issued Hilcorp a Letter of Authorization (LOA) on 1 February 2015 for the incidental taking of small numbers of polar bears in conjunction with the survey.

A Marine Mammal Monitoring and Mitigation Plan (4MP) was developed and implemented in compliance with the issued IHA and LOA to minimize impacts to marine mammals during sonar survey activities. The 4MP required Hilcorp to employ PSOs for visual based monitoring on the project vessel, the motor vessel (M/V) *Journey*. The vessel had a combination of Iñupiat and scientific PSOs to monitor marine mammals and implement mitigation (e.g., shut down) if a marine mammal approached or entered the exclusion zone of 160 decibels (dB) root mean square (rms) relative to 1 micro pascal (re 1  $\mu$ Pa).

In conjunction with the survey, passive acoustic monitoring data were collected by JASCO Applied Sciences (Alaska), Inc. (JASCO) to augment visual monitoring data specific to the distribution and migration range of marine mammals using autonomous multichannel acoustic recorder systems (AMARs). The operations plan can be found in Appendix A and the report will be submitted separately.

Additionally, Hilcorp developed a Plan of Cooperation (POC) that identified measures to mitigate potential effects from the survey on subsistence species or practices in accordance with Title 50, Code of Federal Regulations, Part 216.104(a)(12) (50 CFR 216.104[a][12]) for the IHA and 50 CFR 18.124 for the LOA.

## 2.0 2015 Hilcorp Survey Project Description

The purpose of Hilcorp's survey was to evaluate the existence and location of archaeological resources, potential geologic hazards on the seafloor and in the shallow subsurface, and to investigate strudel scours and ice gouges in the Liberty field. Figures 2-1 and 2-2 show the survey project area and lines surveyed within Foggy Island Bay. This boundary lies between 70°12'0"N and 70°17'0"N and between 147°32'0"W and 147°46'0"W. The planned survey included 482.8 km (300 mi) of lines, not including turns and cross-lines. The lines were within a 6.5 km<sup>2</sup> (2.5 mi<sup>2</sup>) project area and in water depths ranging from 1 to 13 m (3 to 42 ft). Figure 2-1 includes lines for activities conducted outside of the project area, such as vessel transit, and other vessel movements for project support and logistics.

### 2.1 Project Details

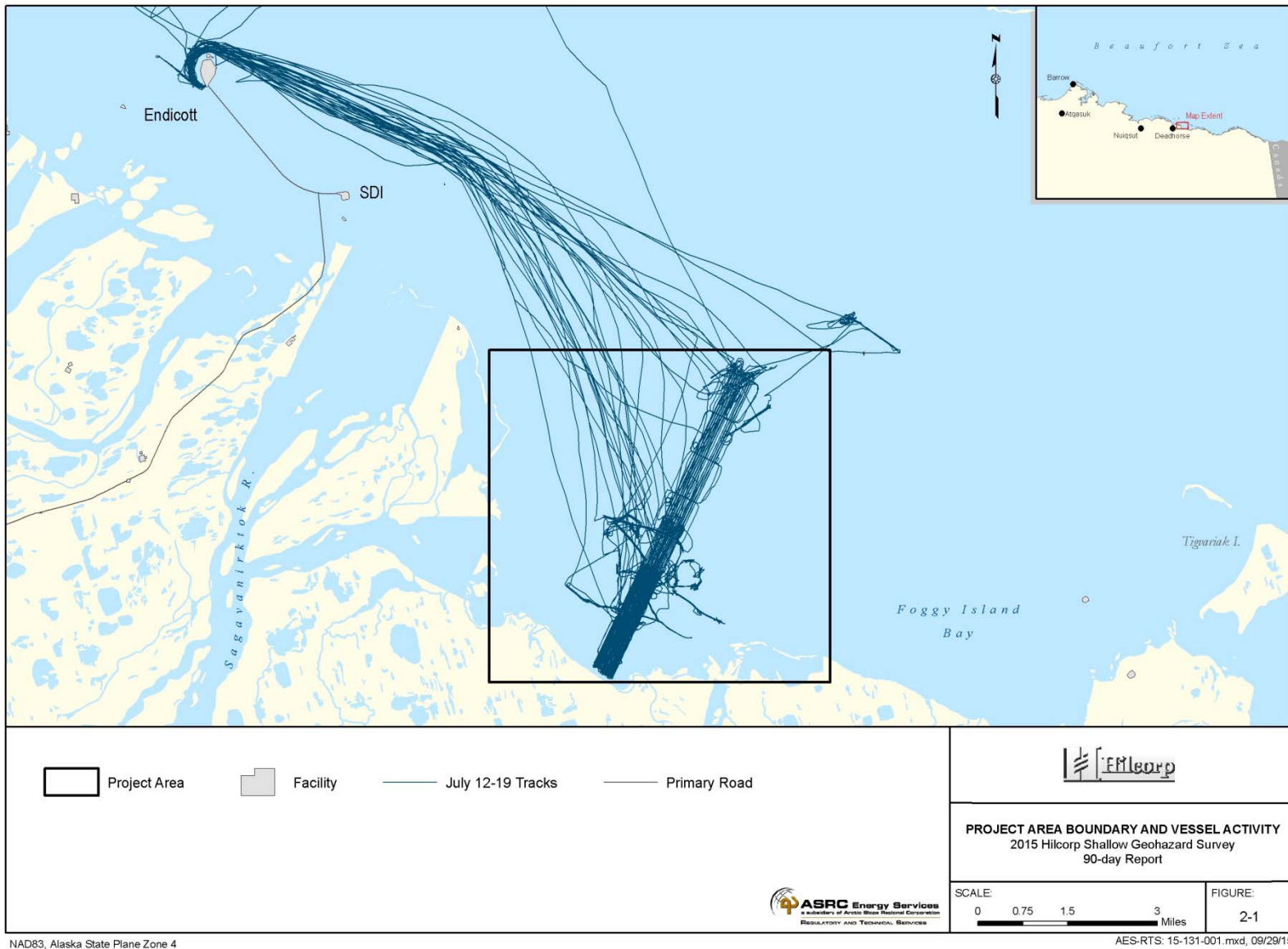
The survey was conducted using various types of equipment, including single-beam and multi-beam echosounders, side scan sonar, high and low resolution sub-bottom profilers, and a magnetometer. The type of equipment used during the survey emitted low level, very high to low frequency continuous acoustic sounds at discrete time periods over very limited areas of the seabed and intervening water column. The operating frequencies of the multi-beam, single-beam, and side scan sonar equipment were outside the hearing range of all marine mammals (Southall et al. 2007). Sound generated by the sub-bottom profiler, however, was within the hearing range of all marine mammal species found in the project area (Southall et al. 2007). The sub-bottom profiler is capable of generating sound pressure levels of 160, 180, and 190 dB re 1 µPa to a distance and depth of 30 m (100 ft) from the source (Warner & McCrodan 2011).

As discussed in 1.0 Introduction, Hilcorp received an IHA from NMFS, authorizing incidental take by Level B harassment of a small number of marine mammals during the 2015 survey. Marine mammals included in the permit were beluga whales (*Delphinapterus leucas*), bowhead whales (*Balaena mysticetus*), gray whales (*Esrichtius robustus*), bearded seals (*Erignathus barbatus*), spotted seals (*Phoca largha*), and ringed seals (*P. hispida*). Level B harassment, as defined by the MMPA, is any disturbance in marine mammal behavior near the survey area as a result of the sound generated during sonar activities. Perceived disturbance and subsequent behavioral reactions in marine mammals are dependent on multiple factors, including species identity, the animal's activities at the time of exposure, distance from the sound source, and received level of sound.

Additionally, Hilcorp received an LOA from USFWS to allow for incidental taking of small numbers of polar bears (*Ursus maritimus*) as a result of the survey. Hilcorp deployed PSOs to monitor marine mammals during project activities aboard the project vessel, M/V *Journey*, as part of mitigation measures required in the IHA and LOA. Both permits are provided in Appendix B.

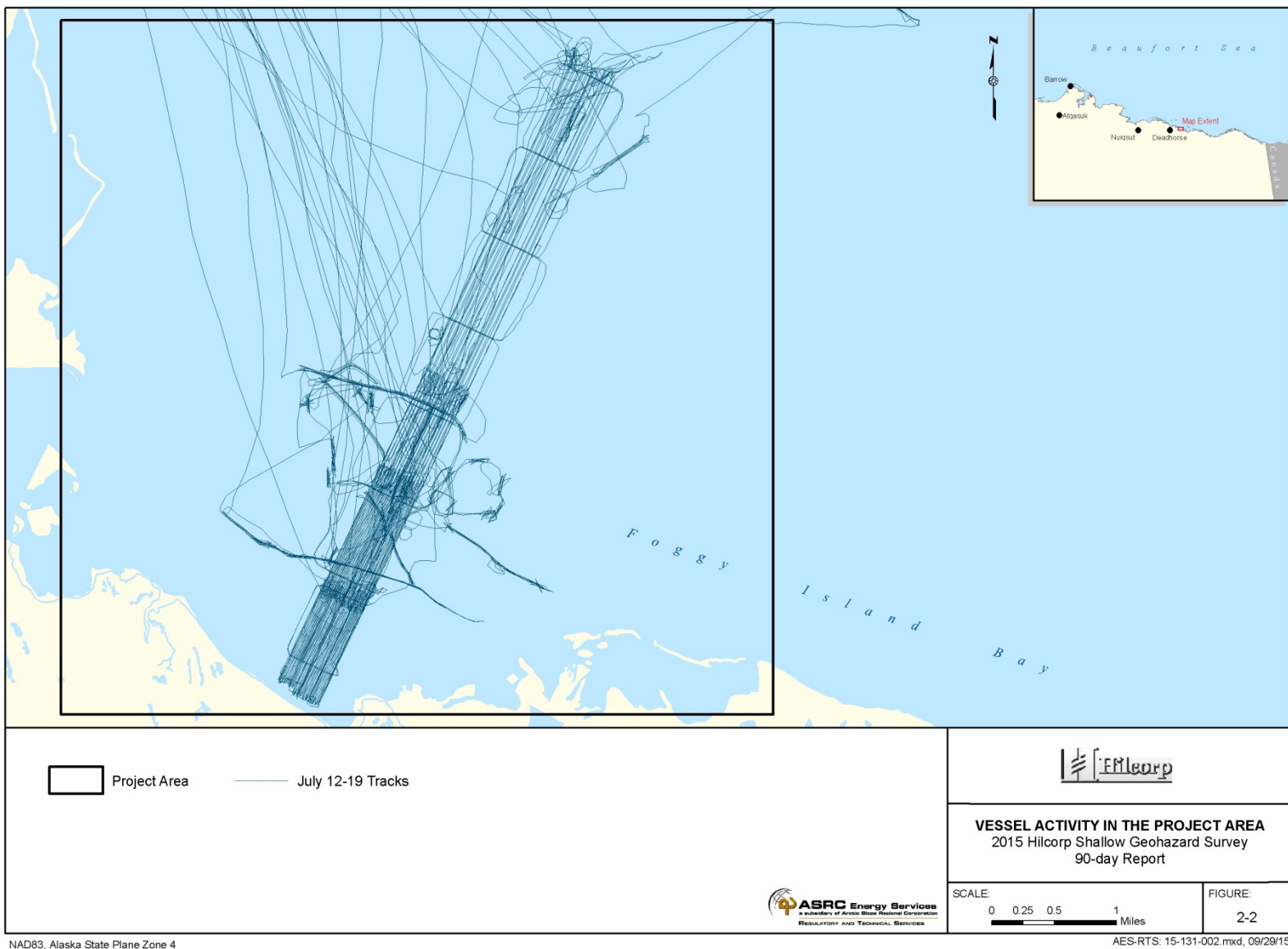
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**Figure 2-1. Project Area Boundary and Vessel Activity**

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**Figure 2-2. Vessel Activity and Project Area**

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### 2.1.1 Dates, Duration, and Region of Activity

Hilcorp's IHA was valid for activities from 1 July through 30 September 2015. The vessel arrived in Endicott Bay, Alaska in early July and began testing of geotechnical equipment on 9 July. Data acquisition began on 12 July and concluded on 19 July. On 20 July, the project was completely demobilized.

The approximate boundaries of the survey were between 70°12'0"N and 70°17'0"N and between 147°32'0"W and 147°46'0"W. The project was conducted solely in state and U.S. federal waters of the Beaufort Sea (Figure 2-1).

### 2.1.2 Vessel and Equipment

The project was conducted in waters ranging between approximately 1 m (3.3 ft) and 13 m (42.7 ft). The small size of the M/V *Journey* was integral in safely towing equipment through shallow waters of the project area. The M/V *Journey* is approximately 14.6 m (48 ft) long and 4.8 m (16 ft) wide and was stationed at Endicott Dock for vessel preparations (assembly and installation of navigation, acoustic, and safety equipment) prior to survey operations. All equipment was tested and calibrated at the dock and at the project site prior to start of the survey.

The survey was conducted using sound producing equipment detailed in Table 2-1. Additionally, a marine magnetometer was used to passively measure changes in magnetic fields over the seabed. Magnetometers do not produce sound, and therefore the project magnetometer was not included in the equipment specifications or as part of the mitigation plan. Monitoring and mitigation were required when the sub-bottom profiler was in use. Therefore, data hereafter are presented in terms of when the sub-bottom profiler was active, during use of all other equipment ("other"), and when no equipment was in use ("none").

**Table 2-1. Equipment specifications**

Description	Survey Type	Operating frequency (kHz)	Horizontal beamwidth (degrees)	Vertical beamwidth (degrees)	RMS Source level (dB re 1 $\mu$ Pa @ 1 m)	Maximum pulse Rate (Hz)
<b>Sound Source</b>						
Edgetech 3200 high-resolution (CHIRP) sub-bottom profiler	Shallow geohazard	2 to 24	15 to 24	15 to 24	210	3 to 10
Applied Acoustics AA251 low-resolution sub-bottom profiler	Shallow geohazard	1 to 4	N/A	N/A	212	Not provided
<b>Other</b>						
Odom single-beam echosounder	Shallow geohazard/ Strudel scour	210	3	3	220	20
Norbit iWBMS multi-beam echosounder	Shallow geohazard/ Strudel scour	400	1.9	0.9	218	40
Edgetech 4125 side scan sonar	Shallow geohazard/ Strudel scour	400 / 900	0.5	50	215	75

kHz = kilohertz

dB re 1  $\mu$ Pa@1m = decibels relative to 1 micro Pascal at 1 meter

Hz = hertz

### 2.1.3 Survey Design

Hilcorp's 2015 survey program was designed to minimize impact to the environment, subsistence activities, marine mammals, birds, and other fauna. The ice gouge and strudel scour surveys involved the use of smaller, higher frequency sound sources, such as multi-beam echosounders and sub-bottom profilers.

Side scan sonar used a device called a "tow-fish" to record images of the seafloor. The tow-fish was towed from the vessel. The side scan sonar emitted regular sound waves from transducers on the side of the tow-fish. These pulses were reflected back to the tow-fish when they encountered an obstruction in their path.

Single and multi-beam echosounders are geophysical survey techniques that use a transducer located underneath the vessel. Similar to side scan sonar, they emit regular sound waves from the transducer, which reflect back when the waves encounter an obstruction in their path.

Two sub-bottom profilers were used: a high-resolution, shallow "CHIRP" and low-resolution, mid-range "boomer." The CHIRP was towed directly behind the vessel and the boomer was towed at a close distance (~30.4 m [~100 ft]). Both sub-bottom profilers emitted sound waves directed at the seabed which penetrated the seafloor to make an image of the geologic layers.

The marine magnetometer does not use sound waves, but detected variations in the Earth's total magnetic field caused by the presence of ferrous (iron) material on or under the seabed. This method has become standard practice for mapping the location of material in the seabed. The magnetometer was towed behind the vessel using a fiber-conductor data cable protected by a polyurethane jacket. A small buoy was attached to the magnetometer in shallow water if additional support was required.

During operations, the M/V *Journey* traveled approximately 4 knots per hour (kts/hr) while surveying and 13 kts/hr during transit. Survey lines were designed in a pattern along main transects situated in a northeast to southwest direction. Not including transit and turns, the total survey distance was 729 km (452 mi).

### 3.0 Summary of Marine Mammals in Project Area

The purpose of this section is to provide a summary description of the marine mammals regularly found in the project area.

The most common marine mammal species located in the Beaufort Sea are the bowhead whale, gray whale, beluga whale, bearded seal, ringed seal, spotted seal, and polar bear. All species of marine mammals, including these, are protected under the MMPA. In addition, four are protected under the ESA; the bowhead whale is endangered and the ringed and bearded seals and polar bear are listed as threatened (75 Federal Register [FR] 77476, 75 FR 77496).

The general status, distribution, and seasonal occurrences of the seven species known to commonly occur within the project area boundary are discussed in the following sections.

#### 3.1 Bowhead Whale

The Western Arctic stock is the largest of four bowhead stocks globally recognized by the International Whaling Commission (IWC 2010; Allen and Angliss 2013) and is found throughout the Bering, Chukchi, and Beaufort seas. It is classified as federally endangered under the ESA (35 FR 18319), however no critical habitat has been designated.

The Western Arctic stock winters in the Bering Sea. From March through June, the stock migrates north and east across the Chukchi Sea following open ice leads and then summers and feeds in the Canadian Beaufort Sea (Braham et al. 1980; Braham et al. 1984; Moore and Reeves 1993; Rugh et al. 2003; Quakenbush et al. 2010; Allen and Angliss 2013). In the fall, these bowhead whales migrate back west past Barrow and through the northern Chukchi Sea, in both U.S. and Russian waters, before turning southeast toward the Bering Sea (Moore et al. 1995; Mate et al. 2000; Quakenbush et al. 2010).

Over the last four decades, the Western Arctic stock has been documented to be steadily increasing in numbers. George et al. (2004) reported the stock increased at a rate of 3.4 percent from 1978 to 2001. During this period, abundance doubled from roughly 5,000 to 10,000 whales (LGL 2012). The Western Arctic stock was recently estimated at 8,250 in 2001 (Allen and Angliss 2013); 12,631 in 2004 (Koski et al. 2010); and 16,892 whales in 2011 (Givens et al. 2013).

#### 3.2 Gray Whale

The Eastern North Pacific gray whale stock ranges from the Bering, Chukchi, and Beaufort seas in the summer to the Gulf of California in the winter (Rice and Wolman 1971; Nerini 1984; Rice 1998; Moore et al. 2003). Most of the stock makes a round-trip annual migration of over 8,000 km (4,971 mi) from Alaska feeding waters to breeding and calving waters in Baja California and Mexico (Rice and Wolman 1971; Rice et al. 1981; Allen and Angliss 2014). From late May to early October, the majority of the population feeds in the Chukchi, Beaufort, and northwestern Bering seas. Typically, gray whales inhabit shallow water, remaining closer to shore than any other large cetacean throughout the year. As a result, they are considered common summer residents in the nearshore waters of the Beaufort Sea.

Like all large whale populations, this stock was once hunted to near extinction by commercial whalers. The stock has since recovered significantly and was removed from the ESA list in 1994. The population is currently estimated at 19,126 whales (Laake et al. 2009; Allen and Angliss 2014).



### 3.3 Beluga Whale

Five beluga stocks occur in Alaska (O’Corry-Crowe et al. 1997; Allen and Angliss 2012), of these the Eastern Chukchi Sea and Beaufort Sea stocks have been documented within the project area boundary. These stocks are thought to have overlap in the Beaufort Sea, though most individuals observed during the project are likely from the Beaufort Sea stock. Both stocks winter in the Bering Sea (Suydam et al. 2001; Allen and Angliss 2012). In the spring, much of the Beaufort Sea stock molts and breeds in coastal estuaries and bays (Allen and Angliss 2012).

The most recent abundance estimate for the Beaufort Sea beluga whale stock, based on aerial survey data and applied correction factors, is 39,258 whales (Duval 1993; Allen and Angliss 2012). Beaufort Sea belugas are not listed as depleted under the MMPA nor listed under the ESA, and the current population trend is unknown.

### 3.4 Ringed Seal

The Alaskan stock of ringed seals are the most abundant marine mammals in the Beaufort, Chukchi, and Bering seas (Frost et al. 1988; Funk et al. 2010; Kelly et al. 2010). In the North Pacific, ringed seals inhabit the southern Bering Sea with their range extending as far south as the Okhotsk and Japan seas (Harwood and Stirling 1992; Allen and Angliss 2013). Ringed seals are year round residents in the Beaufort, Chukchi, and Bering seas and can extend as far south as Bristol Bay in years of extensive ice coverage. They tend to prefer large ice floes (i.e., over 48 m [157 ft] in diameter) and often inhabit interior pack ice where sea ice coverage is over 90 percent (Simpkins et al. 2003; Kelly et al. 2010). Ringed seals remain in contact with ice most of the year and pup on ice from late winter through early spring (Frost 1985; Allen and Angliss 2013).

There is currently no reliable information on population abundance or trends of ringed seals for the entire Alaska stock (Allen and Angliss 2013). A recent population estimate from the combined Beaufort and Chukchi Sea surveys yielded an estimate of at least 300,000 individuals (Kelly et al. 2010; Allen and Angliss 2013). Ringed seals were listed as threatened under the ESA in 2012 and as depleted under the MMPA. In 2014, the National Oceanic and Atmospheric Administration submitted a proposal for critical habitat designation in the Bering, Beaufort, and Chukchi seas, which is currently under review (79 FR 73010).

### 3.5 Spotted Seal

Spotted seals inhabiting the Beaufort Sea belong to the Bering Distinct Population Segment (Allen and Angliss 2012). Spotted seals are coastal pinnipeds that summer in nearshore areas in the Beaufort, Bering, and Chukchi seas and winter along the ice edge in the Bering Sea (Quakenbush 1988; Lowry et al. 1998; Simpkins et al. 2003). During summer months, spotted seals haulout on sand spits in bays and lagoons in the Bering and Chukchi Seas, with some animals ranging into the Beaufort Sea near the Colville River delta (Rugh et al. 1997; Lowry et al. 1998).

A reliable abundance estimate for the Alaskan stock of spotted seals is not currently available (Boveng et al. 2009; Allen and Angliss 2012). However, Ver Hoef et al. (2013) used aerial survey data, modeled ice distributions, and seal haulout locations to derive an estimate of 141,479 spotted seals in the eastern and central Bering Sea (Allen and Angliss 2013).

### 3.6 Bearded Seal

Bearded seals are common in the circumpolar region, including the Beaufort Sea, during the summer (Laidre et al. 2008; Allen and Angliss 2013). Bearded seal distribution is positively correlated with the presence of drifting sea ice. Primarily seafloor feeders, they are rarely found in water depths greater than 200 m (656 ft) (Burns 1981; Allen and Angliss 2013). Bearded seals winter along the ice front in the Bering Sea and move north in the spring with the receding ice edge (Burns and Harbo 1972; Burns 1981; Moulton and Lawson 2002; Allen and Angliss 2013). During summer, populations occur in both the Chukchi and Beaufort seas in areas of high ice coverage along the pack ice edge (Burns et al. 1981; Bengston et al. 2000; Simpkins et al. 2003).

A reliable abundance estimate for the Alaskan stock of bearded seals is not available (Allen and Angliss 2013). The most recent surveys occurred in the summers of 1999 and 2000 between Shishmaref and Barrow with average densities between 0.07 and 0.14 seals per km<sup>2</sup> (approximately 2.6 mi<sup>2</sup> per km<sup>2</sup>), respectively. Early estimates of the Bering and Chukchi population ranged from 250,000 to 300,000 (Burns 1981). The best recent estimate of this population is 155,000 individuals (Cameron et al. 2010; Allen and Angliss 2013). In 2012, bearded seals were listed as threatened under the ESA and as depleted under the MMPA, but the ruling was vacated by a U.S. District judge in 2014.

### 3.7 Polar Bear

Two polar bear stocks exist in Alaska and population estimates for both have a high uncertainty. The Bering/Chukchi Sea stock has a population of >2,000 bears (Walton et al. 2013) and the Southern Beaufort Sea stock has a population of 900 bears (Bromaghin et al. 2015). A recent study compared diet, body condition, and recruitment between stocks indicated the Bering/Chukchi Sea stock may be in better condition than the Southern Beaufort Sea stock (Rode et al. 2013). The worldwide abundance estimate of polar bears is between 22,000 to 32,000 animals (PBSG 2014).

Polar bears were listed as threatened, range wide, under the ESA on 14 May 2008 due to projections of future habitat loss (sea ice recession) linked to global climate change (73 FR 82212). A final special rule under Section 4(d) of the ESA for polar bear was published on 16 December 2008 (73 FR 76249). Although USFWS designated over 480,000 km<sup>2</sup> (187,000 mi<sup>2</sup>) as critical habitat in 2010, there is currently no critical habitat designated for polar bears as a result of a 2013 U.S. District Court decision. Polar bears are under USFWS jurisdiction.

## 4.0 Marine Mammal Monitoring and Mitigation Program Summary

This section describes measures implemented through Hilcorp's 4MP to address and supplement requirements specified in the NMFS issued IHA and USFWS issued LOA for Hilcorp's 2015 shallow geohazard and strudel scour survey. Copies of both permits can be found in Appendix B. Seafloor-mounted acoustic monitoring was conducted by JASCO from July through September 2015. The operations plan can be found in Appendix A and the summary report will be submitted separately. Section 5.0 Marine Mammal Monitoring Analysis and Results provides a detailed summary of data analysis methods and results of the marine mammal monitoring and mitigation program.

### 4.1 Purpose

Vessel based monitoring and mitigation was designed to minimize sound exposure to marine mammals, prevent conflict with subsistence species and users, and document potential effects on marine mammals through compliance with provisions of the IHA and LOA. Monitoring and mitigation measures were conducted by PSOs onboard the vessel. Specifically, PSO tasks included:

- Monitoring: Record data in reference to marine mammals both during sub-bottom profiler operations and inactive periods, particularly the number of marine mammals present and reactions of the animals, if any.
- Mitigation: Identify marine mammals within or approaching the associated zone of influence (ZOI) and initiate mitigation actions as appropriate.

### 4.2 Mitigation Measures

Mitigation measures implemented during the 2015 survey are summarized in Sections 4.2.1 and 4.2.2. These were implemented during all sub-bottom profiler operations, during mobilization, demobilization, and during all support operations for the project.

#### 4.2.1 General Mitigation Measures

PSOs had authority and responsibility to call for appropriate mitigation measures while aboard the project vessel throughout the duration of the survey. Hilcorp adhered to all mitigation measures during the entirety of their program.

Specific mitigation measures within the IHA and LOA issued to Hilcorp, as applicable, included:

- Speed alterations in order to avoid marine mammals or subsistence activities, provided that doing so would not compromise operational safety. This included reducing vessel speeds to 5 knots or less within 274 m (900 ft) of whales and reducing vessel speeds in conditions of poor visibility.
- The vessel was operated in a manner to avoid causing marine mammals, specifically whales, to make multiple changes in direction.
- Groups and concentrations of whales were avoided and the vessel was operated at the maximum distance possible from such groups. The vessel was operated in a manner to avoid separating individuals in a group of whales.

- PSOs alerted the crew and/or equipment operators to the presence of marine mammals so appropriate mitigation measures (i.e., shut downs and ramp ups) could be initiated. Shut downs were implemented instead of power downs during this survey.
- The sub-bottom profiler was initiated (i.e., powered on) from a cold start (i.e., no active sub-bottom profiler) only during daylight after the full ZOI was visible and clear of marine mammals for 30 minutes immediately prior to initiation, or as otherwise stipulated in the IHA and/or LOA. This included all times after a shut down due to marine mammals within or approaching the ZOI.
- Ramp up procedures were initiated if the sub-bottom profiler was discontinued for 10 minutes or more. If the PSO watch had been suspended during this time, a 30-minute pre-clearance of the ZOI was initiated prior to ramp up.
- The sub-bottom profiler was immediately shut down in the event a marine mammal was sighted within, or approaching, the ZOI.
- The vessel did not approach within 0.8 km (0.5 mi) of polar bears on ice or on land.

## 4.2.2 Shallow Geohazard Survey Mitigation Measures

### 4.2.2.1 Monitoring Zone

NMFS and USFWS guidelines currently defines the “exclusion radii” for marine mammals around industrial sound to be 180 dB re 1  $\mu$ Pa (rms) for cetaceans and walruses and 190 dB re 1  $\mu$ Pa (rms) for pinnipeds and polar bears. Disturbance or behavioral effect to marine mammals may occur after exposure from underwater sounds at distances greater than the safety radii (Richardson et al. 1995). NMFS threshold for Level B behavioral harassment from impulse noise is a 160 dB re 1  $\mu$ Pa (rms) radius, hereafter referred to as the ZOI.

Sounds generated by the sub-bottom profiler are within the hearing range of marine mammal species occurring in the project area. The estimated distance to sound pressure levels of 190, 180, and 160 dB re 1  $\mu$ Pa generated by the sub-bottom profiler is less than or equal to 30 m (Table 4.2-1). The operating frequencies of all other equipment (i.e., single-beam, multi-beam, and side scan sonar) are above the hearing range of marine mammals.

**Table 4.2-1. Modeled safety zone radii distance (m) to received sound pressure levels (in dB re 1  $\mu$ Pa [rms]) based on existing modeling data. The observed ZOI was used from 9 July to 19 July.**

Equipment	Distance				Observed ZOI
	190 dB*	180 dB*	160 dB*	120 dB*	
Sub-bottom profiler	<30 m	<30 m	30 m	450 m	50 m

\*Data from existing measurement of geophysical equipment, similar to those used in this survey (Warner and McCroden 2011; Hilcorp IHA 2015 application). Measurements were conducted in water of depths of ~ 35 m (100 ft).

The monitoring zone guidelines are in place to minimize disturbance or behavioral effect to marine mammals. These are based on the assumption that sound energy at lower received levels will not impair marine mammals’ abilities to hear, but higher received levels may have such effects. The mitigation radius of the sub-bottom profiler was conservatively set at 50 m (164 ft) based on previous reviews of similar instruments used in Arctic waters (Warner and McCroden 2011) where the received level would be 160 dB re 1  $\mu$ Pa (rms) or less for all marine mammals. The ZOI was monitored by PSOs during all vessel activities. Mitigation (e.g., shut down) was

implemented when a marine mammal was sighted within, or approaching, the ZOI while the sub-bottom profiler was operational.

In addition to vessel based visual monitoring, JASCO developed a passive acoustic monitoring plan for the shallow geohazard survey (Appendix A). This was designed to document ambient noise conditions, examine spatial and temporal distribution of marine mammals based on acoustic detections of their vocalizations, and characterize long-range propagation of sounds produced during the survey. Passive acoustic data were to be collected with specialized AMARs. AMARs were strategically placed on the seafloor prior to the survey and remained there until after the shallow geohazard survey was complete to collect passive acoustic data.

#### **4.2.2.2 Ramp-up Procedure**

Ramp-up procedures involved a gradual increase in sounds levels. This process involved a gradual increase in the pulse rate of the sub-bottom profiler until the maximum or desired rate was achieved. This procedure is intended to alert marine mammals of sub-bottom profiler activity in the area and allow them time to leave and avoid injury or hearing impairment. PSOs observed for marine mammals during the 30-minute observation period prior to and during ramp-ups. One PSO was on watch during all sub-bottom profiler operations. During ramp-up, the 50 m (164 ft) monitoring zone was maintained.

After a complete shutdown, ramp-up procedures did not commence until the 50 m (164 ft) ZOI was completely visible for at least 30 minutes and no marine mammals had been observed within the ZOI for the same 30 minutes. If a marine mammal was observed within the ZOI within the 30-minute pre-clearance watch period, ramp-up was delayed until the animal was sighted outside the ZOI or the animal was not sighted for at least 30 minutes.

Ramp-up procedures were used when the sub-bottom profiler had been shut down for 10 minutes or more. If PSO watch had been suspended during that time, a 30-minute clearance of the ZOI was conducted prior to commencing ramp-up. Discontinuation of sub-bottom profiler activity for less than 10 minutes did not require a ramp-up.

#### **4.2.2.3 Shutdown Procedure**

A shutdown of the sub-bottom profiler occurred for all sightings requiring mitigation. These procedures were implemented if a marine mammal was observed within, or approaching, the ZOI. Once shut down, source operations resumed only after the marine mammal had been confirmed outside the mitigation zone as described above.

PSOs were instructed to implement emergency shutdowns if observations were made, or credible reports received, that one or more marine mammals within the project survey area was injured, dead, dying, or indicated acute distress due to sub-bottom profiler noise. In the case of an emergency shutdown, NMFS (or USFWS polar bear) would have been contacted immediately. If the marine mammal injury or death was likely not due to survey activities (e.g., obvious signs of animal predation; signs of hunting, such as bullet wounds), information would have been collected as specified by NMFS or USFWS and survey activities would resume. If death or injury could not be attributed to causes other than the survey, activities would not have been restarted until NMFS or USFWS gave approval. No injured or dead marine mammals were observed during the survey.

#### **4.2.2.4 Protocol for Poor Visibility Conditions**

Hilcorp did not operate during any low light or nighttime periods. During times of poor visibility, including fog or inclement weather, the following procedures were in place:

- During limited visibility due to fog or inclement weather, the entire ZOI may not have been visible. If the entire zone was not visible for a minimum of 30 minutes immediately prior to startup of the sub-bottom profiler, initiation did not occur.
- If the sub-bottom profiler was operational before visibility decreased or before nightfall, operations continued even though the entire ZOI may not have been visible.

#### **4.2.3 Mitigation Measures for Subsistence Activities**

All survey activity occurred outside of fall bowhead whaling dates for the villages of Nuiqsut and Kaktovik. Monitoring was conducted at all times the vessel was active (i.e., in transit, surveying, not at dock). PSOs also maintained an open line of communication with other vessels in the area. A shutdown was implemented when any marine mammal was within, or approaching, the 50 m (164 ft) ZOI radius. Communication Centers, as defined by the Alaska Eskimo Whaling Commission's Conflict Avoidance Agreement, were not operating during the Hilcorp survey. However, as a part of their commitments in Hilcorp's POC, they participated monetarily to the Beaufort Communication Centers later in the 2015 open water season.

### **4.3 Monitoring Procedures**

The 2015 Hilcorp survey used a combination of vessel based visual monitoring and bottom mounted passive acoustic recorders. Vessel based PSOs were on board the source vessel to visually monitor the ZOI. All monitoring was implemented in accordance with the provisions of the IHA and LOA. Detailed monitoring methodology for the ZOI is provided in Section 4.3.1. Methodologies used for the acoustic monitoring program are described in Appendix A.

#### **4.3.1 Vessel based Visual Monitoring**

Prior to the start of the project, all PSOs participated in a NMFS approved PSO training course. Topics covered included local marine mammal identification, mitigation and monitoring protocol, data collection methods and the software, and familiarization with Hilcorp operations. PSOs also went through a cold water survival course (e.g., Helicopter Underwater Egress Training or Basic Offshore Safety Induction and Emergency Training). An emphasis was placed on operational procedures and considerations for health, safety, and environmental issues.

There were four PSOs present for the project from 9 July to 19 July. There was a lead PSO on the vessel with additional responsibilities including PSO oversight, data management, and scheduling. PSOs were on watch during all vessel activities including transit times, stationary operations, and low light conditions. PSOs were not on watch when at dock for crew transfers. Due to crew space limitations and to allow for 24-hour operations, two PSOs were on shift for 12 hours with watch periods of no more than four consecutive hours. Crew changes occurred twice daily from Endicott Dock and included a PSO crew change. PSOs rotated observations every two hours as possible to manage observer fatigue. At least one PSO was on watch for all pre-clearance and ramp-ups. Although not stipulated in the IHA, at least one PSO remained on watch during non-required periods to provide additional marine mammal monitoring.

Marine mammal observations were conducted from the bridge of the vessel. The approximate eye height on the bridge was 3 m (4.7 ft) above sea level. All operations occurred during periods of light. PSOs systematically scanned the area around the vessel with the naked eye or reticle binoculars (7x50 Fujinon) throughout all vessel activities. During sightings with multiple PSOs on watch, one PSO would maintain visual contact with the marine mammal while the other recorded data. When only one PSO was on watch, the PSO quickly recorded the sighting time then observed as long as possible before recording the sighting data. Distance to a marine mammal was estimated using reticle binoculars, a clinometer, and/or best estimation using the naked eye of the trained observer.

Environmental effort was recorded by PSOs for the duration of their watch in accordance with recommendations made by NMFS and USFWS based on types of data collected during previous projects. Data collected included, but were not limited to, date, time, vessel activity (i.e. transit, sub-bottom profiler active, ramp-up, etc.), water depth, Beaufort sea state, visibility, glare, sea-ice cover and type, vessel position, and vessel speed. Environmental effort data were collected every 30 minutes or when conditions or activities changed significantly.

Similarly, when a marine mammal was sighted, additional data were recorded. This included, but was not limited to, date, time, species, number of animals in group, number of juveniles, closest point of approach (CPA) to the vessel, location of animal (in the water or on ice/land), latitude and longitude of sighting, heading of the animal, behavior at the time of sighting and behavioral reaction to the vessel (if any), vessel latitude and longitude, water depth, vessel activities, and the time mitigation measures were requested and implemented (if required). All data were entered into an observation software program, which has a built-in system for quality control and verification of data (i.e., only allowed certain data to be entered and automatically populated specific data, such as latitude/longitude, water depth, etc.). Section 5.0 Marine Mammal Monitoring Analysis and Results details the analysis performed on data collected. All data were exported to Microsoft Excel for quality control (e.g. fixing inconsistent data, mis-entered codes, etc.) and analysis.

## 5.0 Marine Mammal Monitoring Analysis and Results

This section describes the data analysis and results of marine mammal monitoring that occurred during Hilcorp's 2015 shallow geohazard and strudel scour survey in the Beaufort Sea. Monitoring and mitigation methods were summarized in Section 4.0 Marine Mammal Monitoring and Mitigation Program Summary of this report and in the IHA and LOA (Appendix B). For clarity, the numeric values in this section are presented in metric units only and a metric-to-imperial unit conversion table is provided on page iv.

### 5.1 Marine Mammal Monitoring Data Analysis Methods

#### 5.1.1 Classification of Data

PSO effort and sighting data were classified by categories based on the species grouping, vessel activity, and environmental conditions. These categories are comparable to similar surveys conducted under IHAs in the Arctic (e.g; Patterson et al. 2007; Bles et al. 2010; Cate et al. 2014) and are defined below in Sections 5.1.1.1 to 5.1.1.4.

##### 5.1.1.1 Protected Species Observer Effort

As noted above, latitude and longitude were collected every 30 minutes, when conditions changed significantly, and when a sighting occurred. PSO effort was expressed in number of km and hour (h) and comprised all periods when observers were on watch. On-watch effort defines all times when there was a dedicated PSO observing for marine mammals. To calculate PSO effort, all latitude and longitude data acquired during PSO efforts were exported into Excel and the length of each line segment was calculated in km. Survey lines and turns were calculated comprehensively because distances were short (<1 mi) and often took only minutes. PSOs noted times of line start and end, but did not collect new effort data for each turn as an effort to maximize monitoring time with their eyes on the water (not on the computer). Effort is categorized by different environmental and survey activities as described in Section 5.1.1.4 Sound Source Periods.

##### 5.1.1.2 Species Group

Data were pooled together regardless of species for data analysis because of the limited number of sightings. Because no polar bears were observed during the Hilcorp's 2015 geohazard survey, they are not further discussed in this report.

##### 5.1.1.3 Project Area and Density Estimates

Data were collected during all operational periods (i.e., not at dock). Figure 2-1 shows the transit and project area used for all data analysis, including take calculations. Due to the limited number of marine mammal sightings (27 total), it is not reasonable to calculate species densities to estimate the number of exposures to sub-bottom profiler sound when more accurate density studies exist that are corrected for perception bias and availability. The procedure described in Section 5.1.3 Estimated Number of Exposures was used to obtain a minimum and maximum estimated number of marine mammal exposures greater than or equal to 160 dB re 1 $\mu$ Pa for comparison with the numbers as estimated in the IHA, similar to methods in BPXA 2012. The results of these calculations are also presented in the same section.



#### 5.1.1.4 Sound Source Periods

PSO data, including PSO effort and sightings, were divided into three categories based on sound source activity;

- (1) Sub-bottom profiler: periods when the sub-bottom profiler was active, including both ramp-up and full power times.
- (2) Other: periods when instruments other than the sub-bottom profiler were active, including magnetometer, echosounders, and side scan sonar.
- (3) None: periods when no sound source was active.

#### 5.1.2 Sighting Rates

Various factors may bias sighting rates of marine mammals; therefore data are presented to best capture potential effects of sub-bottom profiler activity on behavior, movement, and distribution of marine mammals. Specifically, PSO effort and sighting data were analyzed in categories defined by environmental conditions and operational activities according to the criteria described below in Section 5.1.2.1 Usable Data for Sighting Rates. Sighting rates for each were calculated as number of animals per km of usable on-watch PSO effort. Potential take estimates were calculated using sighting rate per hour (sightings/hr). Those results are presented in Section 5.1.3 Estimated Number of Exposures. Various environmental conditions and vessel activities were considered during analysis including:

- Number of on-watch PSOs
- Beaufort sea state
- Visibility
- Ice cover

##### 5.1.2.1 Usable Data for Sighting Rates

Periods of PSO effort were excluded when detections of marine mammals at the surface would have been unlikely, such as periods of reduced visibility (e.g., dense fog) or during high seas states. If these data were included in the analysis, sighting rates and densities would be biased downward. There were no times when another vessel was within 1 km (0.6 mi) of the project vessel during operations, therefore additional vessels were not considered as a confounding factor.

Effort and sighting data were excluded from sighting rate calculations if they occurred during the periods listed below. Reactions to the survey and vessel activity are assumed to be different between cetaceans and pinnipeds. As a result, different criteria are used for each group comparable to surveys in the Chukchi Sea (Blees et al. 2010; Hartin et al. 2011; Bisson et al. 2013; Cate et al. 2014). However, due to the limited number of sightings, all sightings were pooled together and represented as cetaceans and pinnipeds. The list below is a classification of data that were not usable. All data that did not fall into these categories is hereafter referred to as “usable” data.

- Periods when the vessel speed was <2 knots;
- Times with impaired visibility including:
  - Darkness/nighttime observations, however this project did not operate in darkness/nighttime;

- Visibility distance <1 km (variable classifications of <3.5 and >3.5 km (<2.2 and >2.2 mi) were considered as usable data);
- Sea state  $\geq$  Beaufort 4 (see Appendix E for description); or
- Severe glare  $>60^\circ$  within the forward  $180^\circ$  of the vessel.

### 5.1.2.2 Behavioral Observations and Animal Distribution

The rate at which marine mammals recover behaviorally after exposure to underwater noise (i.e., post-sub-bottom profiler activity) is unknown since comparisons are limited by the inability to confidently identify re-sighted individuals, short sighting duration when the animals are at the surface, and vessel/animal movements away from the observers. Therefore, specific criteria were implemented to best assess potential behavioral responses or potential changes in distribution resulting from the presence of sub-bottom profiler activity.

To distinguish between potential differences in behavior and distribution of marine mammals with survey activity, data were categorized as sub-bottom profiler, other, and none. Behavioral observations of marine mammals were limited during this project by observational challenges, such as the often brief duration of sightings when marine mammals are at the water's surface, potential for vessel avoidance, and difficulty in positively identifying re-sightings (determining if two sightings occurring close in time are the same animal[s]). Marine mammals were also not able to be tracked for long periods or distances as the vessels were constantly moving along pre-determined track lines.

Marine mammal sighting data were collected during the survey by PSOs and allow for inferences of potential responses to be determined, in similar fashion to data collected in other programs in the Chukchi and Beaufort seas (Blees et al. 2010; Hartin et al. 2011; BPXA 2012; Bisson et al. 2013; Cate et al. 2014). Specifically, data used to assess distribution and behaviors were:

- Distance of the initial sighting of marine mammal(s) from the PSOs position on the vessels;
- Bearing of the animal's position relative to the heading of the vessel at the time of initial marine mammal sightings;
- Observed initial behavior of the mammals;
- The mammal's movements relative to vessel movements and activities; and
- Any observable reactions of marine mammals in response to vessel or survey activities.

### 5.1.2.3 Closest Point of Approach

The distance of each marine mammal observed was determined by the trained PSOs from the observer's position using reticle binoculars for animals further away and estimated using the length of the vessel as a guide for closer mammals. The CPA of each sighting to the observers was assigned at the time of sighting. The high-resolution sub-bottom profiler (CHIRP) was active during some sightings and no sightings occurred when the low-resolution (boomer) was active. For the purposes of this report, since the CHIRP was towed directly at the stern, the CPA of each sighting to was the distance from the animal to the PSO.

### 5.1.2.4 Marine Mammal Movement, Behavior, and Reaction

All movement, behavior, and reactions were recorded for each marine mammal sighting then compared to vessel activities following protocol previously applied in other Arctic marine

mammal monitoring programs (e.g., Blees et al. 2010; Cate et al. 2014). Marine mammal movements relative to the vessel were placed into five categories: 1) swim away, 2) swim toward, 3) parallel, 4) none, and 5) unknown.

For each sighting, the initial behavior observed by the PSO(s) was recorded, and included: blow, breach, dive, fluke, porpoise, resting, surface active, surface active travel, swim, travel, sink, thrash, look, and unknown.

### 5.1.3 Estimated Number of Exposures

Exposures to received sound levels greater than 160 dB re 1  $\mu$ Pa (rms) are considered to be a “take by harassment” (Level B harassment) (NMFS 2005; USFWS 2008a,b). Such exposure is considered by NMFS and USFWS to potentially result in disturbance of pinnipeds and cetaceans. The minimum number of marine mammals potentially exposed to this sound level is assumed to be the number of animals actually observed within the applicable ZOI during sub-bottom profiler operations. This approach has been applied previously by various monitoring studies in the Chukchi and Beaufort seas (Blees et al. 2010; BPXA 2012; Cate et al. 2014), as well as other offshore areas around the world (e.g., Smultea et al. 2004, 2005; MacLean and Koski 2005).

In this survey, five pinniped sightings occurred while the sub-bottom profiler was operational. Two were outside of the 160 db re 1 $\mu$ Pa radius and the ZOI and three required mitigation due to seals approaching or within the ZOI. While some marine mammals may have been missed, there was at least one observer on-watch during all operations and additional crew members watching the gear and surrounding waters. Using the actual number of sightings is representative of the minimum number of animals potentially exposed, even when potential for missing sightings are considered.

Due to the limited number of animals observed, density estimation was not feasible from this data set; however, more reliable data with correction factors do exist for the marine mammal species observed. In similar surveys conducted in shallow coastal waters of the Beaufort Sea, the common practice is to obtain maximum exposure limits to calculate sighting rates using total hours of effort during all watch periods when the sub-bottom profiler was not in use. Sighting rates would be calculated per hour of effort (# sightings/hr) for periods when all sound source equipment was not active. This assumes the sighting rate when the sub-bottom profiler was not in use is representative of undisturbed animals, and was used to calculate the number of sightings which could have occurred during periods when the sub-bottom profiler was operational. However, this method is typically used to correct for nighttime periods when marine mammals are not visible and are potentially missed. Since there were no nighttime periods during this survey, this method is not feasible and yields estimates lower than the number actually observed. To account for this, a blanket correction factor of four was multiplied to all marine mammal sightings, as has been used in previous operations in the Beaufort and Chukchi seas (BPXA 2012; Cate et al. 2014). The maximum estimate of marine mammals potentially affected by the sub-bottom profiler is conservative.

## 5.2 Marine Mammal Monitoring Results

### 5.2.1 PSO Effort

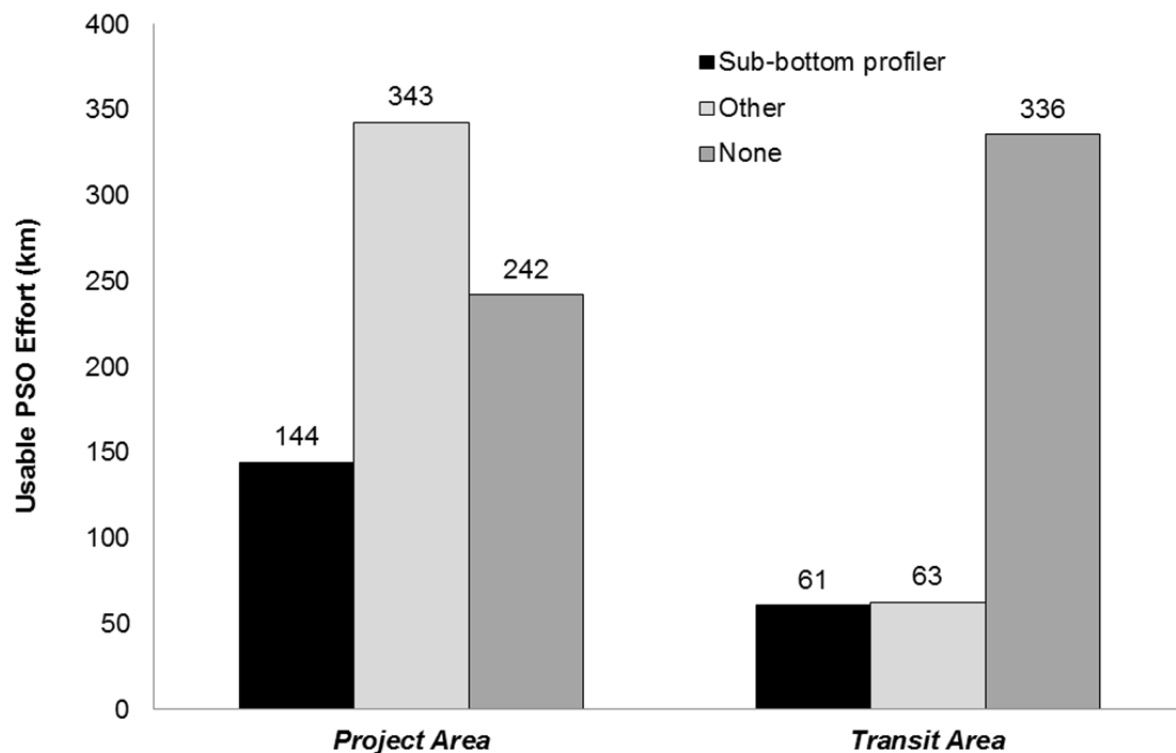
Total observer effort of the survey was 1,187 km (126 h) and is presented in Table 5.2-1. Effort was categorized by three survey activity periods: sub-bottom profiler, other, and none. Other sources included times when additional instrumentation was used that did not emit sound sources in the audible range of marine mammals and therefore were not being mitigated for based on the Hilcorp IHA. This table also presents hours of effort as a reference to the amount of time spent both on- and off-watch.

**Table 5.2-1. Total effort on and off watch during the Hilcorp shallow geohazard survey, 9 July to 19 July 2015.**

Sound Source	Hour	Kilometer
Sub-bottom profiler	22	205
Other	77	405
None	26	577
<b>Total</b>	<b>126</b>	<b>1,187</b>

### 5.2.1.1 Effort by Project Area/Transit Area

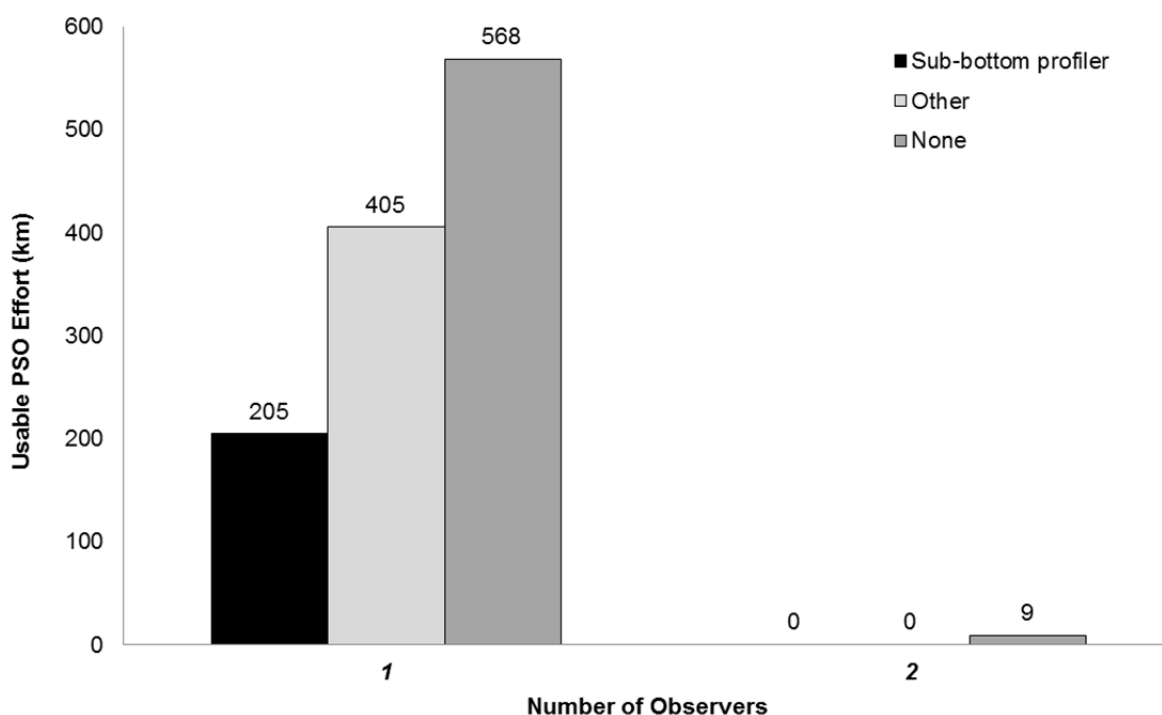
PSO effort was calculated using times when PSOs were on-watch, and is hereafter displayed in kilometers (km) only in tables and figures. Usable PSO effort is summarized in Figure 5.2-1 in transit and survey area regions. The majority of PSO effort occurred within the project survey area.



**Figure 5.2-1. On-watch PSO observation effort (km) by survey and transit area (outside the project area boundary) during the Hilcorp shallow geohazard survey, 9 July to 19 July 2015.**

### **Effort by Number of PSOs**

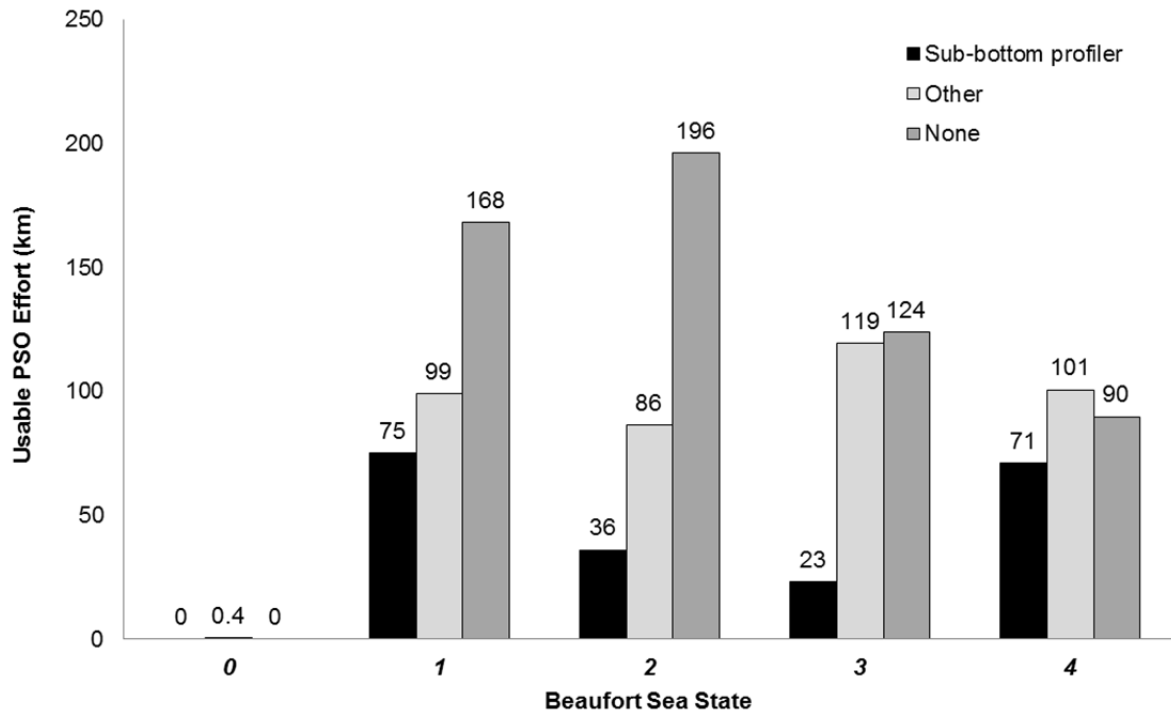
The number of PSOs on watch varied from one to two observers depending on vessel activities (i.e. pre-clearance, ramp-up, etc.) and marine mammal activity (e.g., additional PSOs were sometimes called to watch when marine mammals were sighted) (Figure 5.2-2). Due to vessel space limitations, only two PSOs could be onboard at once. Crew changes occurred roughly every 12 hours. Therefore, at least one PSO was on watch during all on-watch effort including at least 30 minutes prior to initiation of sub-bottom profiler activities and during ramp-up.



**Figure 5.2-2. Usable PSO effort (km) by number of PSOs during the Hilcorp shallow geohazard survey, 9 July to 19 July 2015.**

### **Effort by Sea State**

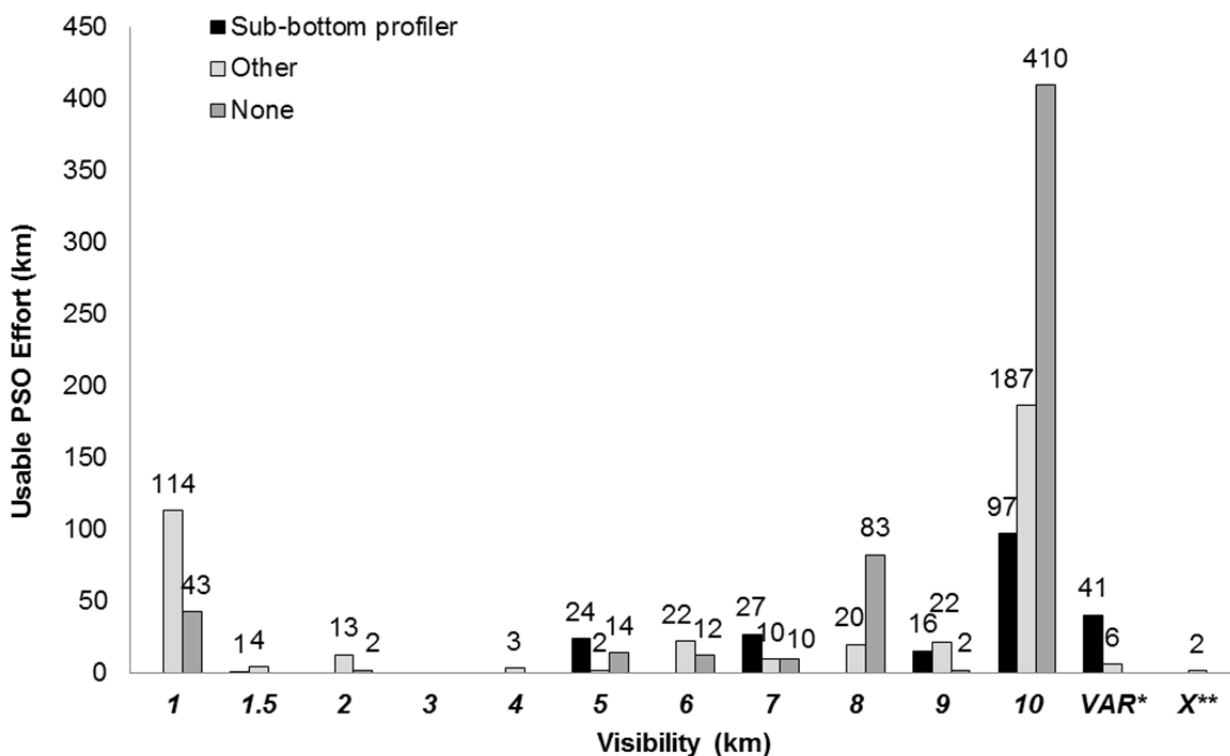
The ability to detect marine mammals can be confounded by adverse sea states. During the survey, Beaufort sea state, which is a scale representing the combination of wave height and wind speed ranged from zero to four (Figure 5.2-3). Overall PSO effort was greatest during a Beaufort sea state of one (totaling 342 km [213 mi]). Sub-bottom profiler activity occurred 31 percent of the time, on average, during the survey. Of this, the sub-bottom profiler was active most during Beaufort sea states of one and four.



**Figure 5.2-3. Usable effort (km) by Beaufort sea state during the Hilcorp shallow geohazard survey, 9 July to 19 July 2015.**

### Effort by Visibility

Visibility can influence the detectability of marine mammals. Visibility may be reduced by rain, darkness, fog, and even by obstructions from objects (i.e., vessels and ice). Usable PSO effort occurred during visibility of greater than zero km through 10 km (6.2 mi) (Figure 5.2-4), where 10 indicated maximum visibility to the horizon. The greatest amount of PSO effort (59 percent) occurred when visibility was 10 km (6.2 mi) or greater. While sub-bottom profiler was not in operation, the second highest amount of PSO effort (13 percent) occurred when visibility was 1 km (0.6 mi).

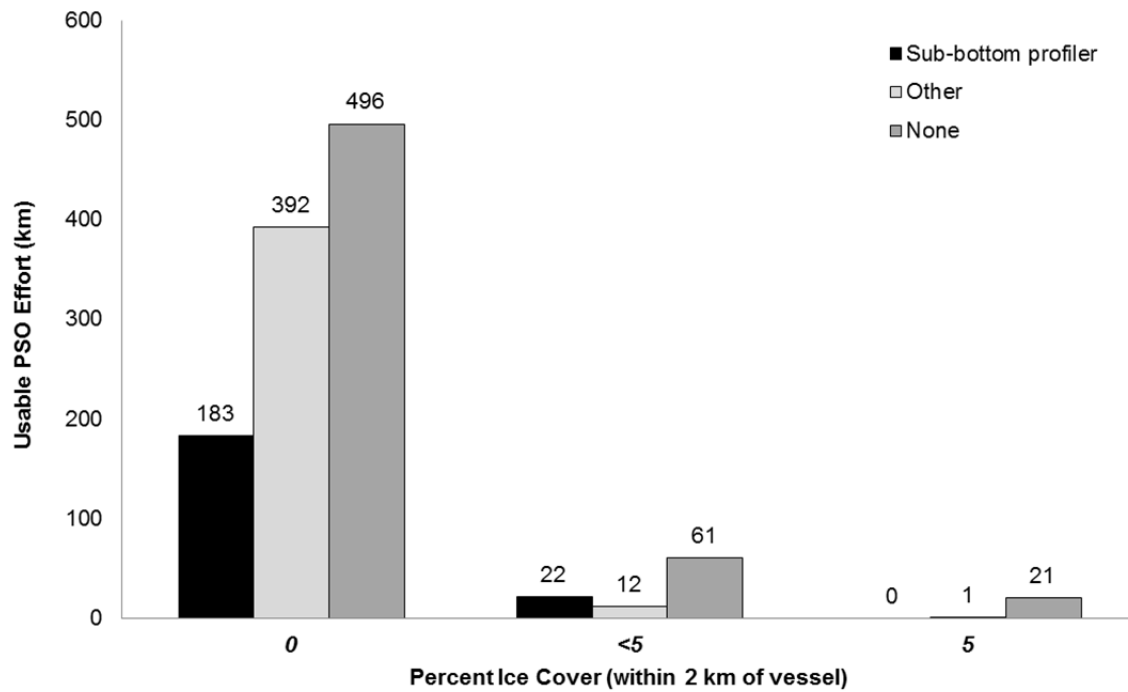


**Figure 5.2-4. Usable PSO effort (km) by visibility distance during the Hilcorp shallow geohazard survey, 9 July to 19 July 2015.**

(\*VAR = variable visibility due to fluctuating fog. \*\*2 km of effort were collected where visibility was not collected.)

### Effort by Ice Cover

Ice in a project can hinder visibility, maneuverability, and project activity. The survey was conducted in primarily (90 percent) ice-free waters (Figure 5.2-5); however, there were occasional encounters with new sea ice. In total, 1,071 km (666 mi) were conducted in waters free of ice. Periods of operation in waters with some ice coverage totaled 116 km (72 mi).



**Figure 5.2-5. Usable PSO effort (km) by percent ice cover within 2 km of vessel during the Hilcorp shallow geohazard survey, 9 July to 19 July 2015.**



## 5.2.2 Sightings

In total, there were 27 sightings of 30 individual animals during the survey (Table 5.2-2 and Appendix C). Of these individuals, five were beluga whales and the rest were pinnipeds. All mammals were identified to at least cetacean or pinniped classification. All sightings were considered “usable” because they were seen during conditions meeting the associated usable criteria described in Section 5.1.2.1 Usable Data for Sighting Rates. Vessel track lines and sightings are mapped in Figure 5.2-6. Due to the minimal number of sightings during this project, all pinniped data were pooled and data are represented as cetacean and pinniped.

**Table 5.2-2. Total sightings during the Hilcorp shallow geohazard survey, 9 July to 19 July 2015.**

<b>Total sightings</b>	<b>No. sightings</b>	<b>No. individuals</b>
Beluga whale*	5	5
Ringed seal	4	4
Spotted seal	7	10
Unknown seal	11	11
<b>Total</b>	<b>27</b>	<b>30</b>

*\*Likely the same animal, but unable to confirm so, recorded as independent sightings.*

Appendix C provides a summary of all marine mammals observed during the survey, including number of individuals, initial behavior and reaction, CPA, animal position relative to the vessel, vessel activity at time of sighting, and sound source activity.

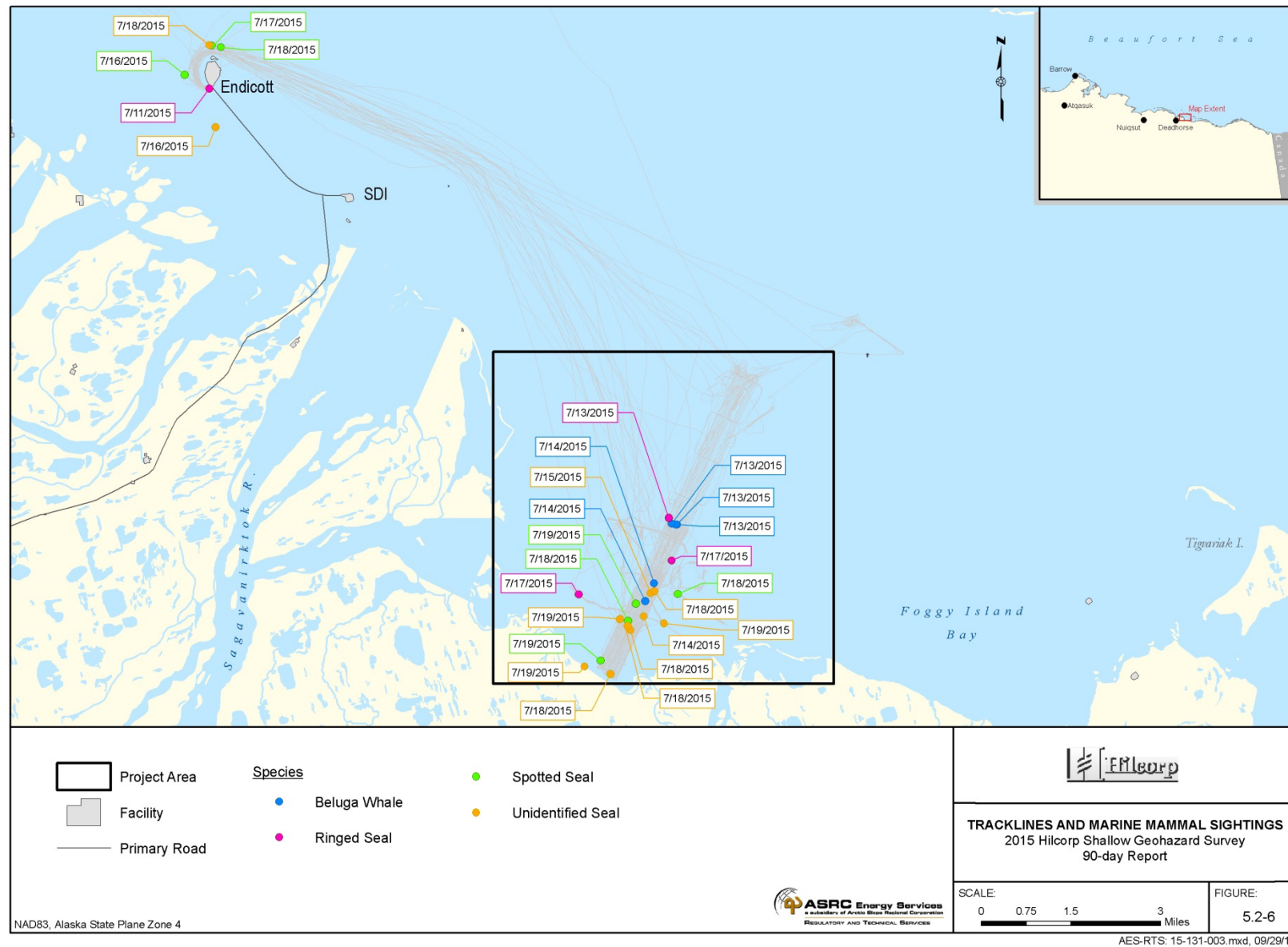


Figure 5.2-6. Tracklines and Marine Mammal Sightings

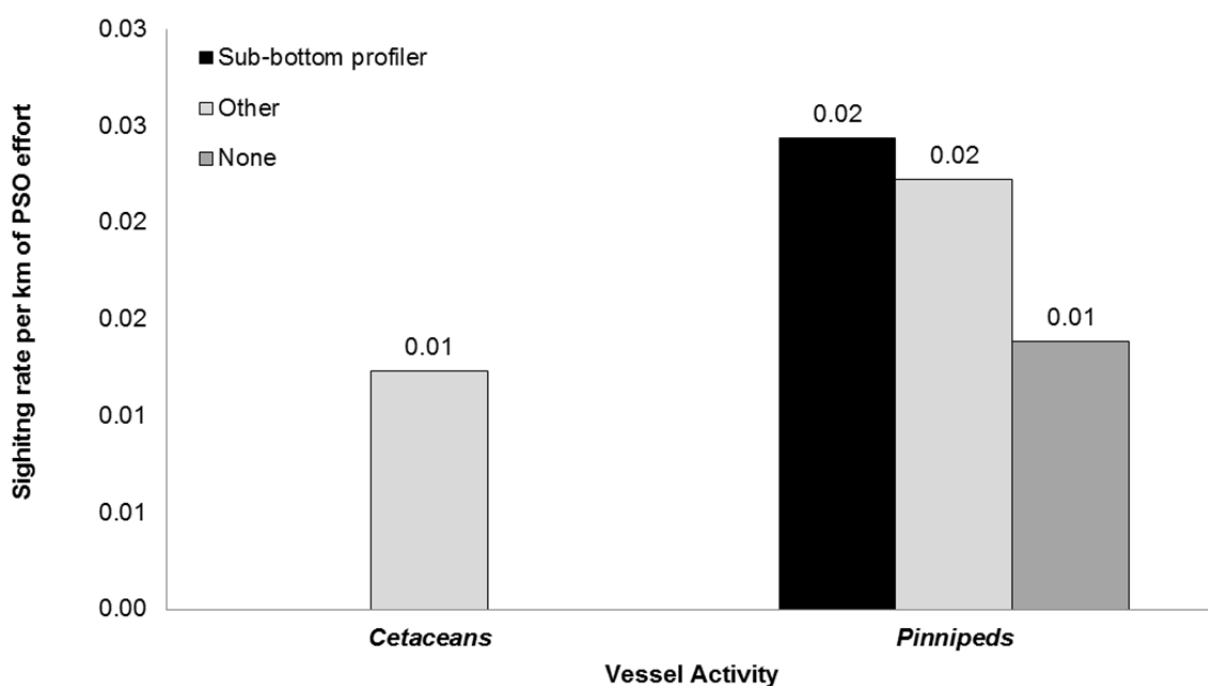
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### 5.2.2.1 Sighting Rates

For reasons described under methods in Section 5.1.2.1 Usable Data for Sighting Rates, all analyses of sighting rates are limited to usable sightings.

#### Sighting Rates by Sound Source

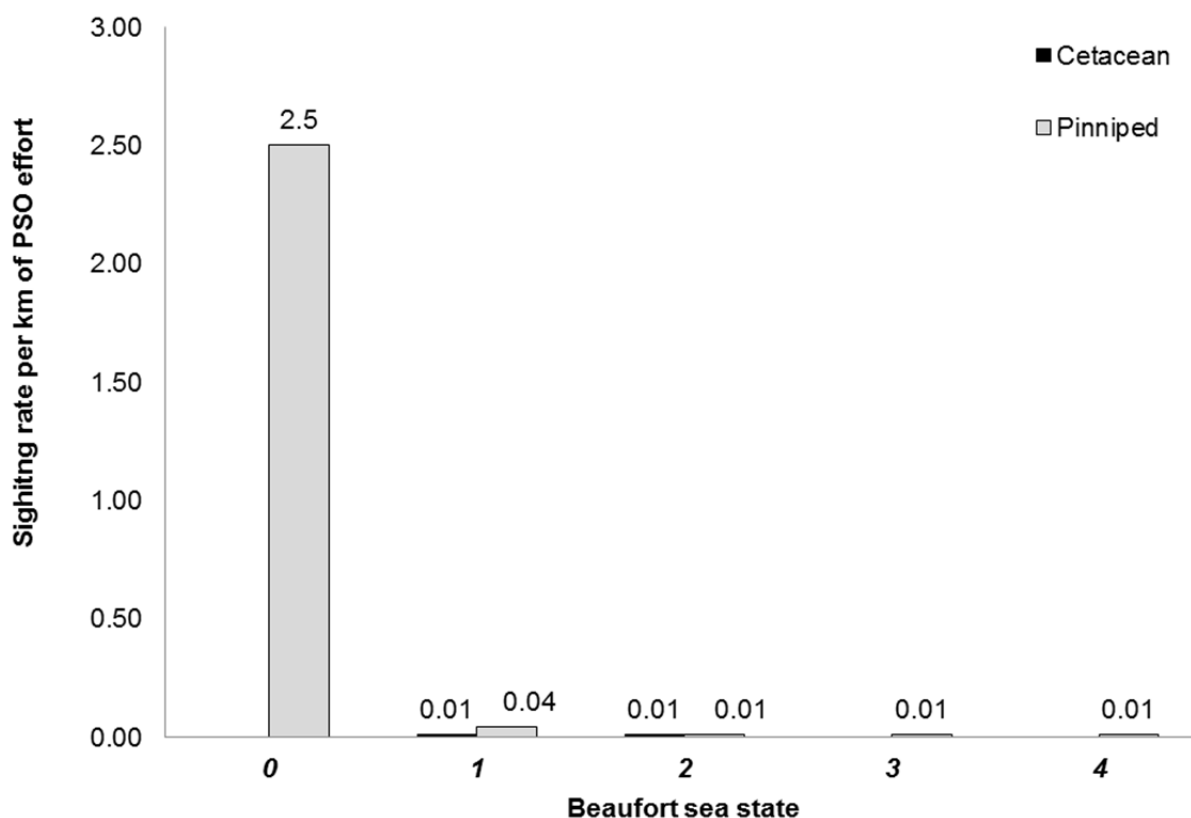
To compare periods of sub-bottom profiler activity versus non-activity, sighting rate, were compared for three operational status periods: while the sub-bottom profiler, other equipment, and no equipment was operating. The highest sighting rates occurred when the sub-bottom profiler was active (Figure 5.2-7). Pinniped sighting rates were higher overall than cetaceans. Cetaceans were only observed when other equipment was in use (0.012 sightings per km of usable PSO effort).



**Figure 5.2-7. Marine mammal sighting rates by vessel activity during the Hilcorp shallow geohazard survey, 9 July to 19 July 2015.**

### **Sighting Rates by Beaufort sea state**

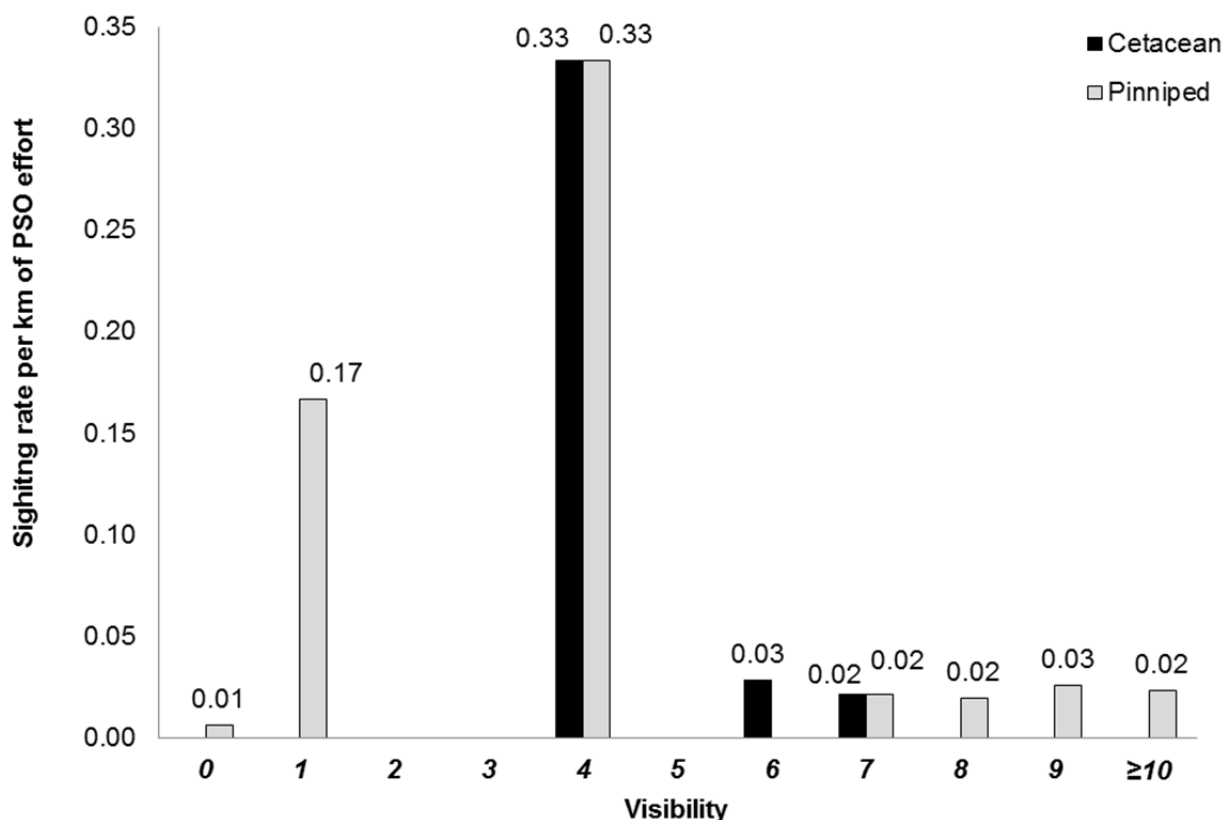
Usable sightings occurred between Beaufort sea states 0 through 4 (Figure 5.2-8). Most watch periods were during Beaufort sea states 1 and 4. The highest sighting rate occurred during Beaufort sea state of 0 (2.5 sightings/km of PSO effort). This is due to the limited amount of effort during that sea state (0.4 km [0.3 mi]).



**Figure 5.2-8. Sighting rates during Beaufort sea state conditions during the Hilcorp shallow geohazard survey, 9 July to 19 July 2015. The absence of a bar indicates no data were recorded for that category.**

### **Sighting Rates by Visibility**

The minimum acceptable visibility for usable cetacean sightings was 1 km (0.6 mi). The highest sighting rate occurred when visibility was 4 km (2.5 mi) (Figure 5.2-9). Most sightings (63 percent) occurred during a visibility of 10 km (6.2 mi) or greater (694 km [431 mi] of usable effort).



**Figure 5.2-9. Sighting rate by visibility distance (km) categories during the Hilcorp shallow geohazard survey, 9 July to 19 July 2015. The absence of a bar indicates no data were recorded for that category. No sightings occurred during periods of variable visibility.**

#### **Sighting Rates by Percent Ice Cover**

Usable sighting data for cetaceans was limited to periods with no ice. Based on usable PSO effort, the overall sighting rate in ice-free waters was 0.005 for cetaceans and 0.02 for pinnipeds per km of PSO effort.

#### **5.2.2.2 Marine Mammal Movement**

Marine mammal movement during the survey was categorized as “parallel”, “no movement”, “swim away”, “swim toward”, or “unknown” (Table 5.2-3). During the survey, at least 40 percent of all observed marine mammals were swimming parallel to the vessel, exhibiting neutral movement. Neutral movement indicated the animal was swimming parallel to the vessel (neither toward nor away). When the sub-bottom profiler was in use, there were only five detections of pinnipeds; two swimming toward, two swimming away, and the other parallel to the vessel.

**Table 5.2-3. Marine mammal movement in relation to the vessel and activity.**

Movement	Sub-bottom		
	profiler	Other	None
<b>Cetacean</b>			
Towards		1	
Away		1	
Parallel		3	
<b>Pinniped</b>			
Toward	2		
Away	2	5	2
Parallel	1	3	4
Unknown		1	2
<b>Total</b>	<b>5</b>	<b>14</b>	<b>8</b>

### 5.2.2.3 Marine Mammal Behavior

The first behavior observed for each sighting was recorded as initial behavior (Table 5.2-4). Swim (70 percent; cetaceans and pinnipeds) and look (26 percent; pinnipeds) were the two most common behaviors observed during the survey. Looking as a first behavior is when the animal is looking above the water surface, but not focused on the vessel. Most animals observed during periods of activity when the sub-bottom profiler was not active were swimming (59 percent). Thirty percent of sightings (all pinnipeds) occurred during sub-bottom profiler operations and seals looked, swam, and were surface active (multiple animals at the surface not traveling, but active at surface).

**Table 5.2-4. Marine mammal behavior in relation to the vessel and activity.**

Behavior	Sub-bottom		
	profiler	Other	None
<b>Cetacean</b>			
Swim		5	
<b>Pinniped</b>			
Look	4	3	
Swim	3	6	5
Surface active	1		
<b>Total</b>	<b>8</b>	<b>14</b>	<b>5</b>

### 5.2.2.4 Marine Mammal Reaction

Most (63 percent) of the 27 sightings exhibited no reaction to the vessel, regardless of survey activity (Table 5.2-5). Specifically, all cetacean sightings exhibited no reaction. The only behavioral reaction (looking) was by pinnipeds during all types of operational status.

**Table 5.2-5. Comparison of behavioral reactions in relation to the vessel and activity.**

Reaction	Sub-bottom profiler	Other	None
<b>Cetacean</b>			
None		5	
<b>Pinniped</b>			
Look	2	3	5
None	3	6	3
<b>Total</b>	<b>5</b>	<b>14</b>	<b>8</b>

### 5.3 Mitigation Measures

For mitigations purposes, Hilcorp shut down the sub-bottom profiler when marine mammals were observed approaching or within the ZOI. The IHA permitted use of the sub-bottom profiler on the lowest setting to deter marine mammals from the immediate survey area (see IHA for regulations in Appendix B).

A total of three mitigation events (i.e., shutdowns) were implemented during the survey as a result of marine mammal sightings within or approaching the applicable ZOI.

Shutdowns for pinnipeds were requested by PSOs and implemented for one sighting on 7 July and two on 19 July. The first shutdown was for a ringed seal sighting and the last two were for spotted seals that approached or were seen within the ZOI as described below and in Table 5.2-6:

- 17 July: A ringed seal initially seen approaching the 50 m (164 ft) ZOI. A shutdown was subsequently implemented in anticipation the seal might enter the ZOI.
- 19 July (1): Two spotted seals were approaching the exclusion zone for the sub-bottom profiler. They swam toward the vessel up to the 50 m (164 ft) ZOI. The sub-bottom profiler was shut down in anticipation the seals might enter the ZOI. The seals were spotted outside the 50 m (164 ft) ZOI after the vessel turned to re-shoot the line. Total shutdown time was less than 10 minutes, so a ramp-up was not implemented prior to commencing the survey.
- 19 July (2): A single spotted seal was observed within the ZOI, 30 m from the vessel. A shutdown was implemented immediately. The seal was spotted behind the vessel, outside of the 50 m (164 ft) ZOI two minutes after the shutdown. Survey re-commenced within 10 minutes of the shutdown.



**Table 5.2-6. The three shutdowns implemented for marine mammals.**

Date	Species	No. animals	Initial behavior	Reaction to vessel	Final CPA to vessel (m)
17-Jul	Ringed seal	1	Swim	Look	60
19-Jul	Spotted seal	2	Swim	Look	50
19-Jul	Spotted seal	1	Swim	None	30

## 5.4 Estimated Number of Marine Mammals Potentially Exposed

Hilcorp's IHA required estimation of the number of potential "takes" of marine mammals through harassment during the 2015 program. Both NMFS and USFWS assume that harassment through disturbance to marine mammals may occur at received sound levels (RSLs)  $\geq 160$  dB re 1  $\mu$ Pa (rms). Furthermore, the NMFS IHA requires that monitoring and mitigation be implemented to avoid exposure of cetaceans to RSLs of  $\geq 180$  dB and of pinnipeds to RSLs of  $\geq 190$  dB re 1  $\mu$ Pa (rms). Absolute numbers of marine mammals potentially exposed to sub-bottom profiler sounds are difficult to calculate for several reasons:

- 1) The relationship of the number of marine mammals actually "taken" and the number observed is uncertain.
- 2) The distance to which a received sound level exceeds a specific criterion (i.e., 190 dB, 180 dB re 1  $\mu$ Pa (rms)) is variable by water depth, especially in shallow coastal waters (Greene et al. 1998; Burgess and Greene 1999; Tolstoy et al. 2004a,b).
- 3) The sound received by marine mammals varies depending on their depth in the water, and will be greatly reduced for animals near the surface (Green et al. 1998).
- 4) The most appropriate criteria for harassment from exposure to sounds are uncertain and presumed to vary among different species in different situations.

The method used to estimate the number of marine mammals exposed to sub-bottom profiler sounds strong enough they may have caused a potential disturbance or other impact is explained in Section 5.1.3 Estimated Number of Exposures. Minimum estimates are based on the number of observed marine mammals at distances corresponding to received sound levels at  $\geq 160$  dB. Maximum estimates were derived by multiplying a correction factor of 4. The estimated maximum number exposed to sub-bottom profiler sounds is conservative; however, it accounts for missed observations during periods of on-watch activity when only one observer was present. Since Hilcorp operated in only daylight hours, this method was used to correct for missed observations due to having only one observer on-watch, assuming the observer can actively see 25 to 50 percent of the water at any one moment. This is the typical method used to calculate maximum number of estimated exposures when observations are limited. It has been used in previous reports (BPXA 2012) to correct for limited data and periods during operations when observers may have missed marine mammals. Pinniped data were pooled together and data are represented as cetacean (beluga whales) and pinnipeds.

The estimated number of marine mammals which may have been taken by harassment through exposure to received levels of sub-bottom profiler sounds  $\geq 160$  dB re 1  $\mu$ Pa (rms) are presented in Table 5.5-1 and are considered the best estimates based on what are considered to be the best available data.

**Table 5.5-1. Best estimates of the potential number of marine mammals exposed to sounds levels  $\geq 160$  dB.**

Species	Number observed	Minimum estimated exposed	Maximum estimated exposed	Authorized 2015 IHA take estimates
Cetaceans	5	5	20	57
Pinnipeds	20	20	80	514
<b>Total</b>	<b>25</b>	<b>25</b>	<b>100</b>	<b>571</b>

In summary, the maximum number of cetaceans potentially exposed to  $RSL \geq 160$  dB based on actual sightings is 35 percent of the estimated numbers in the 2015 IHA. The difference between the maximum and minimum estimates was 15 animals. The maximum number of pinnipeds potentially exposed is 16 percent of the estimated takes in the 2015 IHA. The actual number of potential exposures to Hilcorp's program is likely to have been somewhere between the minimum and maximum exposure estimates and is less than the amount of authorized takes.

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**Appendix A**  
**JASCO Passive Acoustic Monitoring**  
**Operations Plan**





2015 October 1

## **Operations Plan**

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### **Acoustic Monitoring for Hillcorp's Liberty 2015 Geohazard Survey**

P001275-001  
Graham Warner

Version 0.5

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## Approval

This Field Operations Plan has been approved by the following:

Name	Title	Approved
Graham Warner	JASCO Field Lead	24 Jun 2015
Melanie Austin	JASCO Project Manager	30 June 2015
Holly Sneddon	JASCO HSE Representative	30 June 2015
Kate Kauffman	Client Representative	
Heather Ronek	Vessel Master	



## Contents

<b>1. SUMMARY .....</b>	<b>1</b>
<b>2. SCHEDULE OF JASCO OPERATIONS.....</b>	<b>2</b>
<b>3. REQUIREMENTS.....</b>	<b>3</b>
3.1. Resource Requirements .....	3
3.2. Data Requirements .....	3
3.3. Subbottom Profiler Requirements .....	3
3.4. Test Track Requirements.....	3
<b>4. EQUIPMENT .....</b>	<b>4</b>
4.1. Acoustic Recording Configuration.....	4
4.2. Mooring Design .....	4
<b>5. MEASUREMENT PLAN .....</b>	<b>6</b>
5.1. Ambient sound measurements .....	6
5.2. Subbottom Profiler Sound Source Characterization (SSC) .....	7
5.3. Instructions for SSC .....	8
<b>6. DEPLOYMENT PROCEDURE .....</b>	<b>9</b>
6.1. Deployment Procedure .....	9
<b>7. RETRIEVAL PROCEDURE .....</b>	<b>13</b>
<b>8. REPORTING .....</b>	<b>16</b>
<b>9. HEALTH, SAFETY AND ENVIRONMENT .....</b>	<b>17</b>
<b>10. CONTACTS .....</b>	<b>18</b>
10.1. JASCO Contacts .....	18
10.2. Hilcorp Contacts .....	18

## Tables

Table 1. Planned deployment locations of each AMAR.....	6
Table 2. Coordinates of the sound source characterization test track lines for the subbottom profiler. ....	7

## Figures

Figure 1. Mooring design with AMAR resting on the seafloor and sinking ground line for grapple recovery. ....	4
Figure 2. Mooring layed out in JASCO's Halifax warehouse. On deployment, the ground line will be fully stretched out to allow a larger target for grapple retrieval. ....	5
Figure 3. Proposed acoustic monitoring area and AMAR locations. ....	6
Figure 4. Test track lines relative to AMAR 1 for the subbottom profiler SSC. Diagram is not to scale. ....	7
Figure 5. M/V Journey ( <a href="http://www.hdradvantage.com">www.hdradvantage.com</a> ). ....	9
Figure 6. An AMAR and bucket of coiled ground line, prepared for deployment.....	10
Figure 7. An AMAR being hand-lowered into water.....	11

Figure 8. Paying out AMAR ground line.....	11
Figure 9. Deployment of grapple anchor.....	12
Figure 10. Grapple arrangement. Note configuration for this retrieval may vary slightly.....	13
Figure 11. Grapple with snagged AMAR ground line. ....	14
Figure 12. Manually retrieving AMAR ground line with attached AMAR and small anchor. ....	15



# 1. Summary

This operations plan covers the acoustic monitoring study planned by JASCO Applied Sciences in support of Hillcorp's planned pipeline placement geohazard survey at the Liberty Prospect for summer 2015. This plan summarizes JASCO's operational requirements, the equipment that will be employed, and the deployment and retrieval methods for that equipment.

Passive acoustic monitoring will be conducted to document ambient noise conditions, to examine the spatial and temporal distribution of marine mammals based on acoustic detections of their vocalizations, and to characterize the long-range propagation of sounds produced during the geohazard survey. The goal of the program is to address knowledge gaps about ambient sound levels and the distributions and migration paths of several marine mammal species including bowheads, belugas, and seals, and to characterize sound levels as a function of distance from a subbottom profiler.

JASCO will use two Autonomous Multichannel Acoustic Recorders (AMARs) to measure underwater sounds before, during, and after the geohazard survey. The AMARs will be deployed before the start of the geohazard survey and will be retrieved at the end of the open water season. Sound levels from a subbottom profiler will be characterized by analyzing acoustic and navigational data collected as the profiler passes the AMARs along specific track lines. JASCO's automated marine mammal detection and classification algorithms will quantify marine mammal vocalizations. Ambient noise levels and statistics will be calculated for sounds recorded on each AMAR.

## 2. Schedule of JASCO Operations

This schedule may be adjusted based on weather and operational constraints. The deployment date is currently scheduled for 6 July 2015.

Days after deployment	Location	Activity
-10	Halifax	JASCO ships equipment via air freight to Prudhoe Bay for pickup
-1	Prudhoe Bay/Endicott	JASCO Field Team arrives in Prudhoe Bay and assembles equipment.
0	Endicott/Liberty Prospect	JASCO Field team boards vessel and deploys 2 AMARs.
1	Prudhoe Bay/Endicott	JASCO Field Team travels back to home offices.
1-14	Liberty Prospect	At one point during the geohazards survey, the subbottom profiler transits along the sound source characterization track lines.
80	Prudhoe Bay/Endicott	JASCO Field Team arrives in Prudhoe Bay and picks up retrieval gear at Endicott.
81	Endicott/Liberty Prospect	AMARs stop recording due to battery limitations. JASCO Field Team boards vessel and retrieves 2 AMARs.
82	Prudhoe Bay/Endicott	JASCO Field Team ships equipment and travels back to home offices. Acoustic data are downloaded once the AMARs arrive in the Halifax office.

## 3. Requirements

### 3.1. Resource Requirements

The following resources are required from the vessel to complete the deployment:

- Deck space to prepare moorings for deployment
- Vessel captain to record backup GPS waypoints for deployment of AMAR and grapple anchor

### 3.2. Data Requirements

JASCO requires the following information to interpret the acoustic data during the SSC tests for the subbottom profiler (Section 5.2):

- Vessel to provide time-stamped GPS navigation data throughout the SSC tests for the subbottom profiler:
  - In an easily parsed format (e.g., spreadsheet or text file)
  - The datum and time zone are specified
  - Provide the offset between GPS position and acoustic center of the source
  - Maximum time between navigation data points of 5 seconds
- Vessel to provide specifications of the subbottom profiler:
  - Manufacturer
  - Model number
  - Source depth
  - Distance behind vessel
  - Frequency range
  - Pulse period
- Vessel to provide the following ancillary information:
  - Vessel name, contact information, vessel dimensions, engine size and type, power setting during SSC, propeller type, wind speed and sea state during the SSC measurement.
  - For back-up purposes, record by hand the times to the nearest second when the vessel passes over Test Track Points 1-8 with the corresponding vessel speeds at those times.

### 3.3. Subbottom Profiler Requirements

- Subbottom profiler must function as for normal operations (frequency, power level, tow depth, etc.)
- Subbottom profiler must capture data throughout the tests to confirm they are operating normally
- Shot spacing less than 15 m for range resolution of sound level measurements

### 3.4. Test Track Requirements

- Must have at least 1 km approach and departure relative to AMAR 1 along each test track segment

## 4. Equipment

### 4.1. Acoustic Recording Configuration

Acoustic measurements will be performed with two AMARs, each equipped with an HTI-99-HF hydrophone (nominal sensitivity -165 dB re 1 V/ $\mu$ Pa) and will record 24-bit samples. AMAR 1 will sample at 64 ksps (10 Hz to 32 kHz recording bandwidth) continuously and AMAR 2 will sample on a duty cycle of 64 ksps for 28 minutes and then 375 ksps for 2 minutes. The higher sample rate for AMAR 2 will be used to record high-frequency beluga whale clicks and whistles. The AMARs will be equipped with 1792 GB of memory and 57 D-cell batteries which results in a battery-limited recording duration of approximately 81 days.

### 4.2. Mooring Design

The mooring is shown below in Figure 1 and Figure 2. Each mooring will rest on the seafloor (the AMAR and its frame are not bouyant) and consists of:

- AMAR with frame
- 100 m sinking ground line
- 10 lbs anchor weight

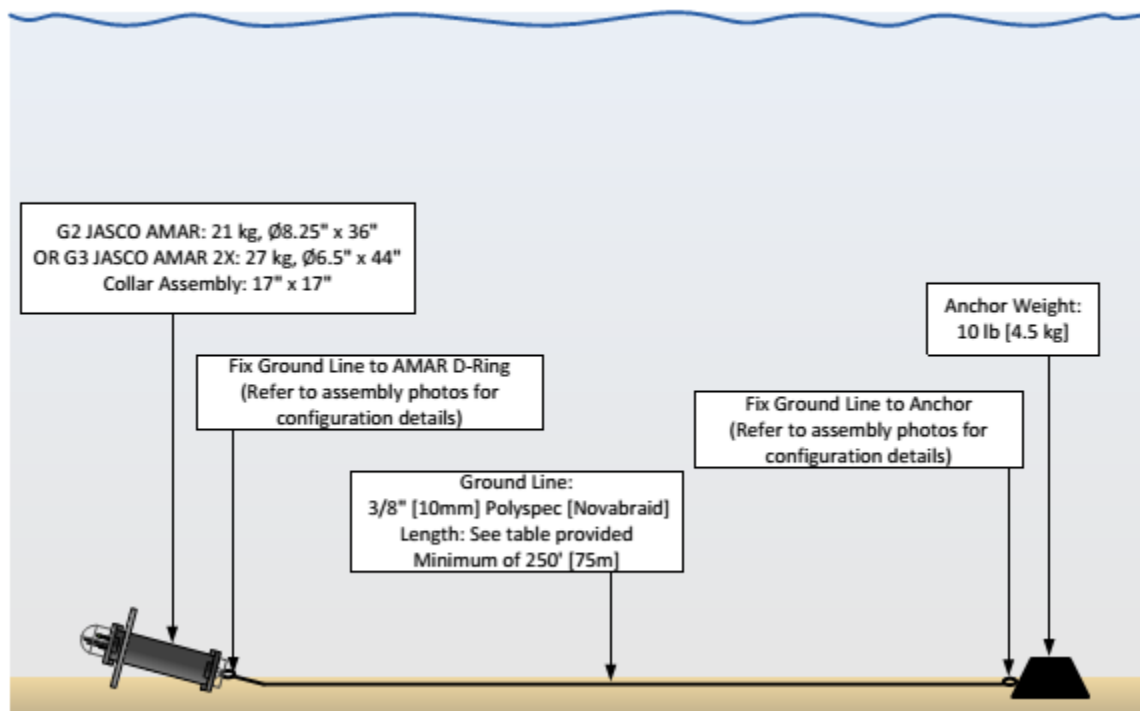


Figure 1. Mooring design with AMAR resting on the seafloor and sinking ground line for grapple recovery.



Figure 2. Mooring layed out in JASCO's Halifax warehouse. On deployment, the ground line will be fully stretched out to allow a larger target for grapple retrieval.

## 5. Measurement Plan

### 5.1. Ambient sound measurements

Two recorders will be deployed near the Liberty prospect and will be aligned with the planned geohazard survey line, at distances of 500 and 5000 m from the offshore end of the survey line for AMAR 1 and 2, respectively (Figure 3). The recorders will be located inside of the barrier islands, an area where there is not expected to be high numbers of bowhead or beluga whale detections.

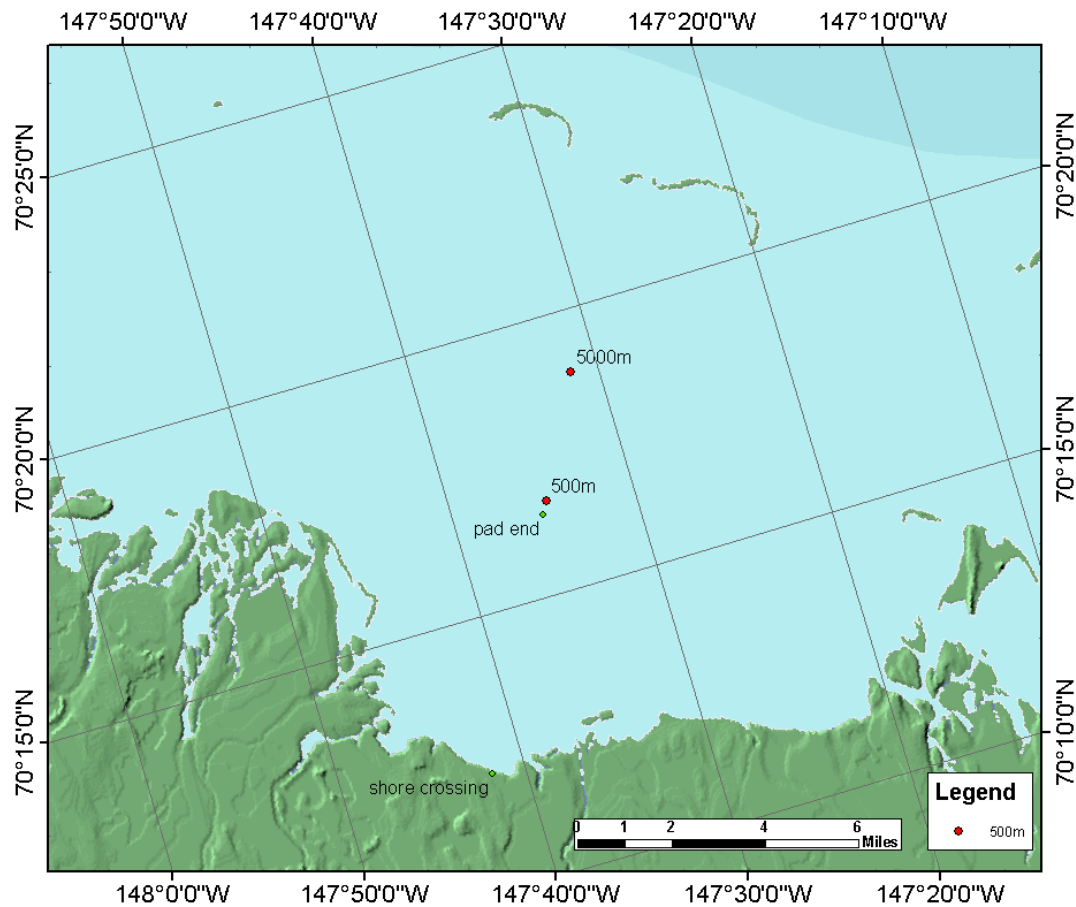


Figure 3. Proposed acoustic monitoring area and AMAR locations.

Table 1. Planned deployment locations of each AMAR.

AMAR	Distance from Liberty pad (m)	Latitude	Longitude
1	500	70° 16.715' N	147° 34.819' W
2	5000	70° 18.873' N	147° 31.563' W

## 5.2. Subbottom Profiler Sound Source Characterization (SSC)

NMFS has requested a sound source characterization (SSC) of the subbottom profiler. The SSC will be conducted near AMAR 1. The subbottom profiler should operate along four survey lines that have closest point of approach at distances of 50, 100, 200, and 500 m. The coordinates of the survey lines are given in Table 2 and Figure 4 shows the survey line geometry. The subbottom profiler should operate as the vessel transits from points 1—8 at normal operating speed and subbottom profiler settings. The subbottom profiler operators must provide JASCO with time-stamped GPS records of the profiler so that JASCO can analyze and characterize sound levels as a function of distance from the profiler.

Table 2. Coordinates of the sound source characterization test track lines for the subbottom profiler.

Track line horizontal offset distance from AMAR 1 (m)	Test track point	Latitude	Longitude
50	1	70° 16.98273' N	147° 36.20282' W
50	2	70° 16.49499' N	147° 33.36262' W
100	3	70° 16.51896' N	147° 33.32649' W
100	4	70° 17.00671' N	147° 36.16674' W
200	5	70° 17.05468' N	147° 36.09456' W
200	6	70° 16.56691' N	147° 33.25423' W
500	7	70° 16.71074' N	147° 33.03741' W
500	8	70° 17.19857' N	147° 35.87798' W

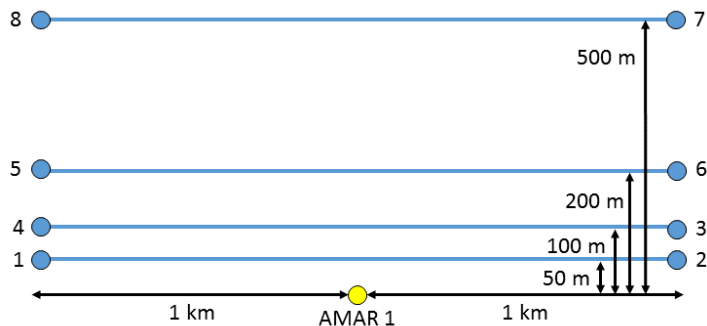


Figure 4. Test track lines relative to AMAR 1 for the subbottom profiler SSC. Diagram is not to scale.

### 5.3. Instructions for SSC

1. Set navigation waypoints for Test Track Points 1-8 as specified in Table 2 and shown in Figure 4.
2. Motor in a straight line from Test Track Point 1 to 2, then 3 to 4, then 5 to 6 and 7 to 8, making sure to pass as closely as possible to each point. Travel at the vessel's normal transiting speed for the present weather conditions. **Record actual speed.**
3. While transiting the track line, **electronically log GPS position and time every 5 seconds or less.** Please identify which time zone is applicable (e.g. AKDT or UTC). A handheld GPS may be used if the data cannot be extracted from the vessel navigation system. **Important:** Some Garmin GPS units discard time information when the current position log is saved to a named track. For Garmin GPS it is recommended to upload the in-memory position log directly instead of first saving to a named track
4. Separately, for back-up purposes, record by hand the times to the nearest second when the vessel passes over each Test Track Point, with the corresponding vessel speeds at those times.
5. Record ancillary information including: vessel name, operating company name, contact information, vessel dimensions, engine size and type, power setting, propeller type, wind speed and sea state during the measurement.

Send GPS track log and all hand recorded information to [Melanie.Austin@jasco.com](mailto:Melanie.Austin@jasco.com)



## 6. Deployment Procedure

The following steps outline the procedure for deploying the AMAR mooring from the M/V *Journey* (Figure 5). The AMAR will be deployed by hand by the JASCO field team. Note that the example photos in this section are from deployment of the AMAR mooring from a much larger vessel than the M/V *Journey*, but the photos are applicable for demonstrating the procedure. This procedure is subject to change based on weather conditions and consultation with the vessel master and crew.



Figure 5. M/V Journey ([www.hdradvantage.com](http://www.hdradvantage.com)).

### 6.1. Deployment Procedure

Each AMAR will be deployed as follows:

- 1. Job Safety Analysis meeting.**
- 2. Prepare the equipment for deployment:**

Securely attach frame collar to AMAR with 2 HCL bands.

Securely attach 4.5 kg grapple anchor to one side of ground line with knot.

Coil ground line in bucket, with grapple anchor at the bottom of the bucket.

Hand carry AMAR (2 people) and bucket of coiled ground line (1 person) to ondeck deployment location.

Ondeck deployment location should be chosen such that line entanglement with vessel propellers and thrusters is mitigated, and such that there is a clear lowering path for the AMAR.

Securely attach loose end of ground line to bottom of AMAR outer frame (non-hydrophone side) with knot.



Figure 6. An AMAR and bucket of coiled ground line, prepared for deployment.

### 3. Deploy the AMAR:

During AMAR deployment, the vessel maintains its position at the proposed deployment location.

Lift part of ground line closest to AMAR over the side of the vessel (AMAR remains on deck). Lift AMAR over side of vessel, using two people if necessary. Control the AMAR to a vertical position over the side of the vessel. Using the ground line, slowly lower AMAR down to the seafloor by hand.



Figure 7. An AMAR being hand-lowered into water.

#### 4. Deploy the ground line:

Once the AMAR is on the seafloor, the vessel starts moving away from the deployment location, in a direction such that the AMAR ground line is guided away from the vessel. Vessel speed is usually 1 kt during this step.

As the vessel moves away from the deployment location, guide the ground line off the vessel and pay out as needed, taking care to neither pay out excess line nor drag the AMAR from its position.



Figure 8. Paying out AMAR ground line.

**5. Deploy the grapple anchor:**

Once all the ground line has been deployed, hold the grapple anchor until the line is taut, being careful not to drag the AMAR from its deployment position.

Drop the 4.5 kg grapple anchor into the water.

**6. Debriefing meeting to capture lessons learned and any HSE concerns.**

Figure 9. Deployment of grapple anchor.



## 7. Retrieval Procedure

The following steps outline the procedure for retrieving each AMAR mooring. Note that the example photos in this section are from recovery of an AMAR mooring from a much larger vessel than the M/V *Journey*, but the photos are applicable for demonstrating the procedure. This procedure is subject to change after consultation with the vessel master and crew. Retrieval usually takes 30 minutes. This operation can be carried out at any time of day as long as there is adequate lighting.

The AMARs will be retrieved as follows:

- 1. Job Safety Analysis meeting.**
- 2. Prepare the equipment for retrieval:**
  - a. Carry grapple equipment (e.g., grapple hooks, chain/wire slings, shackles, swivels) to location of capstain winch or a cleat.
  - b. Assemble grapple (grapple hooks and chain/wire sling in series) on deck and secure to deck while not in use.
  - c. Attach grapple to end of tow rope.
  - d. Attach safety line with snap hook to a secure spot on the ship close to the ondeck retrieval location. This line must be long enough to snap onto AMAR ground line when it is on the grapple.



Figure 10. Grapple arrangement. Note configuration for this retrieval may vary slightly.

- 3. Deploy grapple hooks:**
  - a. Position vessel 50 m perpendicular from the midpoint of the deployed AMAR ground line.
  - b. Deploy grapple hooks over bow of vessel by hand.
  - c. Let out tow rope until grapple hooks are on seafloor (usually indicated by slack in the tow rope). Be careful to pay line out slow enough so that the grapple doesn't get entangled when landing on the seafloor.
- 4. Vessel transits towards AMAR ground line:**
  - a. Vessel transits in a straight line at a constant speed of 0.5-1 kts towards the AMAR ground line.
  - b. While dragging grapple hooks on seafloor, continue to let out tow rope using a constant, slow to medium speed until approximately 50 m of line is deployed.
- 5. Vessel transits over and past AMAR ground line:**

- a. While dragging grapple hooks on seafloor, the vessel transits over and past the ground line.
- b. Continue moving ship over AMAR ground line to a range approximately 50 m past the AMAR ground line.

**6. Retrieve the grapple hooks:**

- a. Use deck winch or pull by hand to retrieve grapples and snagged AMAR ground line. Operate the winch (or pull line in) at constant speed to prevent ground line slipping off of grapple.



Figure 11. Grapple with snagged AMAR ground line.

**7. Retrieve the AMAR and attached ground line:**

- a. Once the grapples break the surface, slowly raise them to within reach of the boat hook held by crew member.
- b. Hook ground line using snap hook (secured to vessel in step 2d above). Carefully bring ground line to side of vessel within reach of second crew member.
- c. Place single loop of ground line around the capstain winch. Bring ground line on board and spool the incoming line into a large bucket. Third crew member watches tail ends of line (in water) for AMAR and anchor and communicates to retrieval team when they get to the surface. Personnel should use waterproof gloves with good grip for this as the AMAR ground line will be wet.
- d. When either anchor or AMAR are at the surface, be careful not to hit AMAR against side of vessel. When the AMAR or anchor get to side of railing, the anchor or AMAR should be manually lifted over the rail.
- e. Once either the anchor or AMAR are safely onboard, retrieve the remaining ground line and AMAR or anchor.



Figure 12. Manually retrieving AMAR ground line with attached AMAR and small anchor.

**8. Post retrieval:**

- a. Manually bring grapple hooks back on board.
- b. Ensure grapple is secured on deck.
- c. While vessel moves to next retrieval location, detach AMAR and small anchor from ground line.
- d. Coil ground line for storage.
- e. Carry AMAR, ground line, and small anchor to JASCO equipment location.

**9. Debriefing meeting to capture lessons learned and any HSE concerns.**

## 8. Reporting

Once the recorders are retrieved, they will be shipped back to the Halifax office where the data will be downloaded and backed up. After the download, the JASCO Field Team will analyze the acoustic data using manual and automated software and write a report. A draft report will be provided to Hillcorp for inclusion in the Project 90-day Report.



## 9. Health, Safety and Environment

The following list indicates the items we request of the vessel crew for the safety of the JASCO team:

- The vessel is required to demonstrate maintenance and valid permits or certificates before use.
- A complete vessel safety orientation will be provided to the JASCO team before the vessel leaves the dock.
- The JASCO team must be satisfied that the vessel crew is competent (for example the presence of a trained crane operator where one is requested).
- The JASCO team must be satisfied that the vessel is well maintained and will meet the needs of the project work before leaving the dock.
- Any new staff including vessel crew should be clearly identified for all in order to ensure that all persons on deck are aware and provide added support for these individuals as needed.
- First Aid in the form required by local regulations must be present on the vessel. All JASCO team members have Standard First Aid, Adult CPR and introduction to AED.
- Where immersion suits are required by law, they will be in good condition and properly sized for the JASCO crew.
- All environmental and safety laws applicable to the vessel will be adhered to.
- Vessel crew will have and use proper PPE for each part of the work. Typical PPE expected would be: PFD worksuit or floater coat, hard hat, gloves, and steel toed boots.
- All involved crew members will participate in the JASCO JSA and toolbox meetings.
- Safety calls and communication plans will be communicated to the JASCO team in advance of the work in order to confirm that such is occurring and to allow for planning time with JASCO's HSE team.
- Disposal at sea will meet all applicable environmental laws.
- Safety requirements of the vessel that JASCO team members will need to adhere to should be communicated to JASCO in advance of the work to ensure compliance.

Any issues or concerns with the above need to be raised in advance of travel. Vessel crew reviewers are asked to notify JASCO in advance of any items that cannot be complied with and reasons why.

## 10. Contacts

### 10.1. JASCO Contacts

Melanie Austin	Project Manager	Tel: +1-907-538-7205	Melanie.Austin@jasco.com
Graham Warner	Field Team Lead	Tel: +1-250-483-3300 x2007 Cel: +1-347-695-8898	Graham.Warner@jasco.com
Ainsley Allen	Field Team Member	Tel: +1-250-483-3300 x2000 Cel: +1-250-508-8085	Ainsley.Allen@jasco.com
Holly Sneddon	HSE Representative	Tel: +1-250-483-3300 x2003 Cel: +1-250-415-3753	Holly.Sneddon@jasco.com

### 10.2. Hilcorp Contacts

Kate Kauffman	Permitting Lead	Tel: +1-907-777-8329 Cel: +1-907-244-8292
Walton Crowell	Operations Lead	<a href="tel:+1-907-777-8402">Tel: +1-907-777-8402</a> Cel: +1-907-570-8177

**Appendix B**  
**Permits: NMFS IHA and**  
**USFWS LOAs**





### Incidental Harassment Authorization

Hilcorp Alaska, LLC (Hilcorp), 3800 Centerpoint Drive, Suite 1400, Anchorage, Alaska 99503, is hereby authorized under section 101(a)(5)(D) of the Marine Mammal Protection Act (16 U.S.C. 1371(a)(5)(D)) and 50 CFR 216.107 to take, by Level B harassment only, small numbers of marine mammals incidental to conducting open-water shallow geohazard surveys in the U.S. Beaufort Sea, contingent upon the following conditions:

1. This Authorization is valid from July 1 through September 30, 2015.
2. This Authorization is valid only for activities associated with Hilcorp's 2015 Beaufort Sea shallow geohazard survey. The specific area where Hilcorp's shallow geohazard survey will be conducted lies within Foggy Island Bay in the U.S. Beaufort Sea, as shown in Figure 1 of Hilcorp's IHA application.
3. (a) The incidental taking of marine mammals, by Level B harassment only, is limited to the following species: bowhead whale; gray whale; beluga whale; ringed seal; bearded seal; and spotted seal, as shown in Table 1.  
  
(b) The authorization for taking by harassment is limited to the following acoustic sources and from the following activities:
  - (i) Sonar sources used for shallow geohazard survey; and
  - (ii) Vessel activities related to the shallow geohazard survey.  
(c) The taking of any marine mammal in a manner prohibited under this Authorization must be reported within 24 hours of the taking to the Alaska Regional Administrator (907-586-7221) or his designee in Anchorage (907-271-3023), National Marine Fisheries Service (NMFS) and the Chief of the Permits and Conservation Division, Office of Protected Resources, NMFS, at (301) 427-8401, or her designee (301-427-8418).
4. The holder of this Authorization must notify the Chief of the Permits and Conservation Division, Office of Protected Resources, at least 48 hours prior to the start of shallow geohazard survey (unless constrained by the date of issuance of this Authorization in which case notification shall be made as soon as possible).

### 5. Prohibitions



(a) The taking, by incidental harassment only, is limited to the species listed under condition 3(a) above and by the numbers listed in Table 1. The taking by injury or death of these species or the taking by harassment, injury or death of any other species of marine mammal is prohibited and may result in the modification, suspension, or revocation of this Authorization.

(b) The taking of any marine mammal is prohibited whenever the required source vessel protected species observers (PSOs), required by condition 7(a)(i), are not onboard in conformance with condition 7(a)(i) of this Authorization.

## 6. Mitigation

### (a) Establishing Zone of Influence (ZOI)

- (i) Establish and monitor with trained PSOs a ZOI zone surrounding the sub-bottom profiler on the source vessel where the received level would be 160 dB (rms) re 1  $\mu$ Pa for all marine mammals.
- (ii) The size of the ZOI is 50 m radius from the source vessel.

### (b) Vessel Movement Mitigation:

- (i) Avoid concentrations or groups of whales by all vessels under the direction of Hilcorp.
- (ii) If any vessel approaches within 1.6 km (1 mi) of observed bowhead whales, except when providing emergency assistance to whalers or in other emergency situations, the vessel operator will take reasonable precautions to avoid potential interaction with the bowhead whales by taking one or more of the following actions, as appropriate:
  - (A) Reducing vessel speed to less than 5 knots within 300 yards (900 feet or 274 m) of the whale(s);
  - (B) Steering around the whale(s) if possible;
  - (C) Operating the vessel(s) in such a way as to avoid separating members of a group of whales from other members of the group;
  - (D) Operating the vessel(s) to avoid causing a whale to make multiple changes in direction; and
  - (E) Checking the waters immediately adjacent to the vessel(s) to ensure that no whales will be injured when the propellers are engaged.

- (iii) When weather conditions require, such as when visibility drops, adjust vessel speed accordingly, but not to exceed 5 knots, to avoid the likelihood of injury to whales.
- (iv) In general, the survey design will start in shallow water and work deeper to mitigate the potential “herding” effect.

(c) Mitigation Measures for Sonar Sources

- (i) Ramp-up:
  - (A) A ramp up, following a cold start, can be applied if the ZOI has been free of marine mammals for a consecutive 30-minute period. The entire ZOI must have been visible during these 30 minutes. If the entire ZOI is not visible, then ramp up from a cold start cannot begin.
  - (B) If a marine mammal(s) is sighted within the ZOI during the 30-minute watch prior to ramp up, ramp up will be delayed until the marine mammal(s) is sighted outside of the ZOI or the animal(s) is not sighted for at least 15 minutes for pinnipeds, or 30 minutes for cetaceans.
  - (C) If, for any reason, the sub-bottom profiler has been discontinued for a period of 10 minutes or more, ramp-up procedures shall be implemented. If the PSO watch has been suspended during that time, a 30-minute clearance of the ZOI is required prior to commencing ramp-up. Discontinuation of sonar activity for less than 10 minutes does not require a ramp-up.
  - (D) The survey operator and PSOs shall maintain records of the times when ramp-ups start and when the sub-bottom profiler reaches full power.
- (ii) Power-down/Shutdown:
  - (A) The sub-bottom profiler shall be immediately powered down whenever a marine mammal is sighted approaching close to or within the ZOI of the sub-bottom profiler at full power, but is outside the ZOI of the sub-bottom profiler at reduced power.
  - (B) If a marine mammal is already within or is about to enter the ZOI when first detected, the sub-bottom profiler shall be shutdown immediately.

- (C) After showdown for more than 10 minutes, ramp-up shall not start until after the marine mammal is visually seen left the ZOI; or 15 minutes have passed after the last detection of the marine mammal with shorter dive durations (pinnipeds and small odontocetes); or 30 minutes have passed after the last detection of the marine mammal with longer dive durations (mysticetes and large odontocetes, including beluga whales).
- (iii) Poor Visibility Conditions:
  - (A) If during foggy conditions, heavy snow or rain, or darkness, the full 160 dB ZOI is not visible, the sub-bottom profiler cannot commence a ramp-up procedure from a full shut-down.
  - (B) If the sub-bottom profiler has been operational before nightfall or before the onset of poor visibility conditions, they can remain operational throughout the night or poor visibility conditions.
- (iv) Firing Sub-bottom Profiler During Turns and Transits
  - (A) Throughout the shallow geohazard survey, during turning movements and short transits, Hilcorp will employ the use of the lowest setting for the sub-bottom profiler to deter marine mammals from being within the immediate area of the survey. The sub-bottom profiler would be operated at approximately one shot per minute and would not be operated for longer than three hours in duration.

(d) Mitigation Measures for Subsistence Activities:

- (i) For the purposes of reducing or eliminating conflicts between subsistence whaling activities and Hilcorp's survey program, the holder of this Authorization will participate with other operators in the Communication and Call Centers (Com-Center) Program. Com-Centers will be operated to facilitate communication of information between Hilcorp and subsistence whalers. The Com-Centers will be operated 24 hours/day during the 2015 fall subsistence bowhead whale hunt.
- (ii) During the time when the Com-Centers are operational, all vessels shall report to the appropriate Com-Center at least once every six hours, commencing each day with a call at approximately 06:00 hours.
- (iii) The appropriate Com-Center shall be notified if there is any significant change in plans. The appropriate Com-Center also shall be called regarding any unsafe or unanticipated ice conditions.



- (iv) Upon notification by a Com-Center operator of an at-sea emergency, the holder of this Authorization shall provide such assistance as necessary to prevent the loss of life, if conditions allow the holder of this Authorization to safely do so.
- (v) Hilcorp shall monitor the positions of all of its vessels and exercise due care in avoiding any areas where subsistence activity is active.
- (vi) Routing barge and transit vessels:
  - (A) Vessels transiting in the Beaufort Sea east of Bullen Point to the Canadian border shall remain at least 5 miles offshore during transit along the coast, provided ice and sea conditions allow.
  - (B) From August 31 to October 31, vessels in the Chukchi Sea or Beaufort Sea shall remain at least 20 miles offshore of the coast of Alaska from Icy Cape in the Chukchi Sea to Pitt Point on the east side of Smith Bay in the Beaufort Sea, unless ice conditions or an emergency that threatens the safety of the vessel or crew prevents compliance with this requirement. This condition shall not apply to vessels actively engaged in transit to or from a coastal community to conduct crew changes or logistical support operations.
  - (C) Vessels shall be operated at speeds necessary to ensure no physical contact with whales occurs, and to make any other potential conflicts with bowheads or whalers unlikely. Vessel speeds shall be less than 10 knots in the proximity of feeding whales or whale aggregations.
  - (D) If any vessel inadvertently approaches within 1.6 kilometers (1 mile) of observed bowhead whales, except when providing emergency assistance to whalers or in other emergency situations, the vessel operator will take reasonable precautions to avoid potential interaction with the bowhead whales by taking one or more of the following actions, as appropriate:
    - Reducing vessel speed to less than 5 knots within 900 feet of the whale(s);
    - Steering around the whale(s) if possible;
    - Operating the vessel(s) in such a way as to avoid separating members of a group of whales from other members of the group;

- Operating the vessel(s) to avoid causing a whale to make multiple changes in direction; and
  - Checking the waters immediately adjacent to the vessel(s) to ensure that no whales will be injured when the propellers are engaged.
- (vii) Hilcorp shall complete operations in time to allow such vessels to complete transit through the Bering Strait to a point south of 59 degrees North latitude no later than November 15, 2015. Any vessel that encounters weather or ice that will prevent compliance with this date shall coordinate its transit through the Bering Strait to a point south of 59 degrees North latitude with the appropriate Com-Centers. Hilcorp vessels shall, weather and ice permitting, transit east of St. Lawrence Island and no closer than 10 miles from the shore of St. Lawrence Island.

7. Monitoring:

(a) Vessel-based Visual Monitoring:

- (i) Vessel-based visual monitoring for marine mammals shall be conducted by NMFS-approved PSOs throughout the period of survey activities.
- (ii) PSOs shall be stationed aboard the survey vessels through the duration of the surveys.
- (iii) A sufficient number of PSOs shall be onboard the survey vessel to meet the following criteria:
  - (A) 100% monitoring coverage during all periods of survey operations in daylight;
  - (B) maximum of 4 consecutive hours on watch per PSO; and
  - (C) maximum of 12 hours of watch time per day per PSO.
- (iv) The vessel-based marine mammal monitoring shall provide the basis for real-time mitigation measures as described in (6)(c) above.
- (v) Results of the vessel-based marine mammal monitoring shall be used to calculate the estimation of the number of “takes” from the marine surveys and equipment recovery and maintenance program.

(b) Protected Species Observers and Training

- (i) PSO teams may consist of Inupiat observers and NMFS-approved field biologists.
- (ii) Experienced field crew leaders shall supervise the PSO teams in the field. New PSOs shall be paired with experienced observers to avoid situations where lack of experience impairs the quality of observations.
- (iii) Crew leaders and most other biologists serving as observers in 2015 shall be individuals with experience as observers during recent seismic or shallow hazards monitoring projects in Alaska, the Canadian Beaufort, or other offshore areas in recent years.
- (iv) Resumes for PSO candidates shall be provided to NMFS for review and acceptance of their qualifications. Inupiat observers shall be experienced in the region and familiar with the marine mammals of the area.
- (v) All observers shall complete a training course designed to familiarize individuals with monitoring and data collection procedures. The training course shall be completed before the anticipated start of the 2015 open-water season. The training session(s) shall be conducted by qualified personnel with extensive crew-leader experience during previous vessel-based monitoring programs.
- (vi) Crew members should not be used as primary PSOs because they have other duties and generally do not have the same level of expertise, experience, or training as PSOs, but they could be stationed on the fantail of the vessel to observe the near field, especially the area around the survey vessels, and implement a power-down or shutdown if a marine mammal enters the safety zone (or exclusion zone).
- (vii) If crew members are to be used as PSOs, they shall go through some basic training consistent with the functions they will be asked to perform. The best approach would be for crew members and PSOs to go through the same training together.
- (viii) PSOs shall be trained using visual aids (e.g., videos, photos), to help them identify the species that they are likely to encounter in the conditions under which the animals will likely be seen.
- (ix) Hilcorp shall train its PSOs to follow a scanning schedule that consistently distributes scanning effort according to the purpose and need for observations. All PSOs should follow the same schedule to ensure consistency in their scanning efforts.
- (x) PSOs shall be trained in documenting the behaviors of marine mammals. PSOs should record the primary behavioral state (i.e., traveling,

socializing, feeding, resting, approaching or moving away from vessels) and relative location of the observed marine mammals.

(c) Marine Mammal Observation Protocol

- (i) PSOs shall watch for marine mammals from the best available vantage point on the survey vessels, typically the bridge.
- (ii) Observations by the PSOs on marine mammal presence and activity shall begin a minimum of 30 minutes prior to the estimated time that the sub-bottom profiler is to be turned on and/or ramped-up. Monitoring shall continue during the survey operations and last until 30 minutes after the sonar equipment stop firing.
- (iii) For comparison purposes, PSOs shall also document marine mammal occurrence, density, and behavior during at least some periods when the sonar equipment used for survey is off.
- (iv) PSOs will scan the area around the vessel systematically with reticle binoculars (e.g.,  $7 \times 50$  and  $16-40 \times 80$ ) and with the naked eye. GPS unit and laptop computer(s) will also be available for PSOs onboard survey vessels.
- (v) Personnel on the bridge shall assist the marine mammal observer(s) in watching for marine mammals.
- (vi) PSOs aboard the marine survey vessel shall give particular attention to the areas within the marine mammal ZOI around the source vessel, as noted in (6)(a)(i) and (ii). They shall avoid the tendency to spend too much time evaluating animal behavior or entering data on forms, both of which detract from their primary purpose of monitoring the exclusion zone.
- (vii) Monitoring shall consist of recording of the following information:
  - (A) The species, group size, age/size/sex categories (if determinable), the general behavioral activity, heading (if consistent), bearing and distance from survey vessel, sighting cue, behavioral pace, and apparent reaction of all marine mammals seen near the survey vessel (e.g., none, avoidance, approach, paralleling, etc);
  - (B) The time, location, heading, speed, and activity of the vessel (sub-bottom profiler firing or not), along with sea state, visibility, cloud cover and sun glare at (I) any time a marine mammal is sighted (including pinnipeds hauled out on barrier islands), (II) at the start and end of each watch, and (III) during a watch (whenever there is a change in one or more variable);

- (C) The identification of all vessels that are visible within 5 km of the survey vessel whenever a marine mammal is sighted and the time observed;
  - (D) Any identifiable marine mammal behavioral response (sighting data should be collected in a manner that will not detract from the PSO's ability to detect marine mammals);
  - (E) Any adjustments made to operating procedures; and
  - (F) Visibility during observation periods so that total estimates of take can be corrected accordingly.
- (vii) Distances to nearby marine mammals will be estimated with binoculars containing a reticle to measure the vertical angle of the line of sight to the animal relative to the horizon. Observers may use a laser rangefinder to test and improve their abilities for visually estimating distances to objects in the water.
  - (viii) PSOs shall understand the importance of classifying marine mammals as "unknown" or "unidentified" if they cannot identify the animals to species with confidence. In those cases, they shall note any information that might aid in the identification of the marine mammal sighted. For example, for an unidentified mysticete whale, the observers should record whether the animal had a dorsal fin.
  - (ix) Additional details about unidentified marine mammal sightings, such as "blow only," mysticete with (or without) a dorsal fin, "seal splash," etc., shall be recorded.
  - (x) When a marine mammal is seen approaching or within the exclusion zone applicable to that species, the marine survey crew shall be notified immediately so that mitigation measures described in (6) can be promptly implemented.

(d) Field Data-Recording and Verification

- (i) PSOs aboard the vessels shall maintain a digital log of shallow geohazard survey, noting the date and time of all changes in survey activity (ramp-up, power-down, shutdowns, etc.) and any corresponding changes in monitoring radii in a software spreadsheet.
- (ii) PSOs shall utilize a standardized format to record all marine mammal observations and mitigation actions (sub-bottom profiler power-downs, shut-downs, and ramp-ups).

- (iii) Information collected during marine mammal observations shall include the following:
  - (A) Vessel speed, position, and activity
  - (B) Date, time, and location of each marine mammal sighting
  - (C) Number of marine mammals observed, and group size, sex, and age categories
  - (D) Observer's name and contact information
  - (E) Weather, visibility, and ice conditions at the time of observation
  - (F) Estimated distance of marine mammals at closest approach
  - (G) Activity at the time of observation, including possible attractants present
  - (H) Animal behavior
  - (I) Description of the encounter
  - (J) Duration of encounter
  - (K) Mitigation action taken
- (iv) Data shall be recorded directly into handheld computers or as a back-up, transferred from hard-copy data sheets into an electronic database.
- (v) A system for quality control and verification of data shall be facilitated by the pre-season training, supervision by the lead PSOs, and in-season data checks, and shall be built into the software.
- (vi) Computerized data validity checks shall also be conducted, and the data shall be managed in such a way that it is easily summarized during and after the field program and transferred into statistical, graphical, or other programs for further processing.

(e) Passive Acoustic Monitoring

- (i) Hilcorp shall conduct passive acoustic monitoring using fixed hydrophone(s) to
  - (A) Document ambient noise conditions;

- (B) Examine the spatial and temporal distribution of marine mammals based on acoustic detections of their vocalizations; and
  - (C) Characterize the long-range propagation of sounds produced during the geohazard survey.
- (ii) Bottom-Mounted Acoustic Sensors:
- (A) Recorders shall be capable of recording marine mammal sounds and making both ambient and anthropogenic noise measurements.
  - (B) Two recorders be deployed near the Liberty prospect and be aligned with the geohazard survey line, at distances of 500 m (AMAR with sampling rate of 64 kHz) and 5000 m (AMAR with sampling rate of 380 kHz) from the offshore end of the survey line.
  - (C) Recorders shall be located inside of the barrier islands.

#### 8. Data Analysis and Presentation in Reports:

(a) Estimation of potential takes or exposures shall be improved for times with low visibility (such as during fog or darkness) through interpolation or possibly using a probability approach. Those data could be used to interpolate possible takes during periods of restricted visibility.

(b) Hilcorp shall provide the information collected, plus a number of summary analyses and graphics to help NMFS assess the potential impacts of Hilcorp's survey. Specific summaries/analyses/graphics would include:

- (i) A table or other summary of survey activities (i.e., did the survey proceed as planned);
- (ii) A table of sightings by time, location, species, and distance from the survey vessel;
- (iii) A geographic depiction of sightings for each species by area and month;
- (iv) A table and/or graphic summarizing behaviors observed by species;
- (v) A table and/or graphic summarizing observed responses to the survey by species;
- (vi) A table of mitigation measures (e.g., power-downs, shutdowns) taken by date, location, and species;

- (vii) A graphic of sightings by distance for each species and location;
- (viii) A table or graphic illustrating sightings during the survey versus sightings when the sub-bottom profiler was silent; and
- (ix) A summary of times when the survey was interrupted because of interactions with marine mammals.

(c) Hilcorp shall collaborate with other industrial operators in the area to integrate and synthesize monitoring results as much as possible (such as submitting “sightings” from their monitoring projects to an online data archive, such as OBIS-SEAMAP) and archive and make the complete databases available upon request.

## 9. Reporting:

(a) Technical report: A draft technical report will be submitted to the Director, Office of Protected Resources, NMFS, within 90 days after the end of Hilcorp’s 2015 open-water shallow geohazard survey in the Beaufort Sea. The report will describe in detail:

- (i) Summaries of monitoring effort (e.g., total hours, total distances, and marine mammal distribution through the study period, accounting for sea state and other factors affecting visibility and detectability of marine mammals);
- (ii) Summaries that represent an initial level of interpretation of the efficacy, measurements, and observations, rather than raw data, fully processed analyses, or a summary of operations and important observations;
- (iii) Summaries of all mitigation measures (e.g., operational shutdowns if they occur) and an assessment of the efficacy of the monitoring methods;
- (iv) Analyses of the effects of various factors influencing detectability of marine mammals (e.g., sea state, number of observers, and fog/glare);
- (v) Species composition, occurrence, and distribution of marine mammal sightings, including date, water depth, numbers, age/size/gender categories (if determinable), group sizes, and ice cover;
- (vi) Data analysis separated into periods when the sub-bottom profiler is operating and when it is not, to better assess impacts to marine mammals;
- (vii) Sighting rates of marine mammals during periods with and without the sub-bottom profiler (and other variables that could affect detectability), such as:
  - (A) Initial sighting distances versus survey activity state;



- (B) Closest point of approach versus survey activity state;
  - (C) Observed behaviors and types of movements versus survey activity state;
  - (D) Numbers of sightings/individuals seen versus survey activity state;
  - (E) Distribution around the survey vessel versus survey activity state; and
  - (F) Estimates of take by harassment;
- (viii) A clear comparison of authorized takes and the level of actual estimated takes;
  - (ix) Cumulative sound exposure level over 24 hours (cSEL<sub>24</sub>), in particular during the use of the two sub-bottom profilers;
  - (x) Ground-truth of data collected by AMARs in consultation with biologists experienced in Arctic species vocalizations with error rates for automatic detection to ensure the accurate classification of vocalizations by species; and
  - (xi) Information of source levels and other acoustic characteristics of the active acoustics survey equipment, such as spectral content, and received levels in root-mean-squared (RMS) dB, sound exposure level (SEL), dB peak to peak and 1/3 octave bands.

(b) The draft technical report shall be subject to review and comment by NMFS. Any recommendations made by NMFS must be addressed in the final report prior to acceptance by NMFS. The draft report will be considered the final report for this activity under this Authorization if NMFS has not provided comments and recommendations within 90 days of receipt of the draft report.

(c) Hilcorp will share data and work with its contractor JASCO to collaborate with other researchers. The passive acoustic recording data, including data on marine mammal vocalizations, will be made publically available for researchers.

10. (a) In the unanticipated event that survey operations clearly cause the take of a marine mammal in a manner prohibited by this Authorization, such as an injury or mortality (e.g., ship-strike, gear interaction, and/or entanglement), Hilcorp shall immediately cease survey operations and immediately report the incident to the Chief, Permits and Conservation Division, Office of Protected Resources, NMFS, at 301-427-8401 and/or by email to [Jolie.Harrison@noaa.gov](mailto:Jolie.Harrison@noaa.gov) and [Shane.Guan@noaa.gov](mailto:Shane.Guan@noaa.gov) and the Alaska Regional Stranding Coordinators

([Aleria.Jensen@noaa.gov](mailto:Aleria.Jensen@noaa.gov) and [Barbara.Mahoney@noaa.gov](mailto:Barbara.Mahoney@noaa.gov)). The report must include the following information:

- (i) Time, date, and location (latitude/longitude) of the incident;
- (ii) The name and type of vessel involved;
- (iii) The vessel's speed during and leading up to the incident;
- (iv) Description of the incident;
- (v) Status of all sound source use in the 24 hours preceding the incident;
- (vi) Water depth;
- (vii) Environmental conditions (e.g., wind speed and direction, Beaufort sea state, cloud cover, and visibility);
- (viii) Description of marine mammal observations in the 24 hours preceding the incident;
- (ix) Species identification or description of the animal(s) involved;
- (x) The fate of the animal(s); and
- (xi) Photographs or video footage of the animal (if equipment is available).

Activities shall not resume until NMFS is able to review the circumstances of the prohibited take. NMFS shall work with Hilcorp to determine what is necessary to minimize the likelihood of further prohibited take and ensure MMPA compliance. Hilcorp may not resume their activities until notified by NMFS via letter, email, or telephone.

(b) In the event that Hilcorp discovers an injured or dead marine mammal, and the lead PSO determines that the cause of the injury or death is unknown and the death is relatively recent (i.e., in less than a moderate state of decomposition as described in the next paragraph), Hilcorp will immediately report the incident to the Chief, Permits and Conservation Division, Office of Protected Resources, NMFS, at 301-427-8401, and/or by email to [Jolie.Harrison@noaa.gov](mailto:Jolie.Harrison@noaa.gov) and [Shane.Guan@noaa.gov](mailto:Shane.Guan@noaa.gov) and the NMFS Alaska Stranding Hotline (1-877-925-7773) and/or by email to the Alaska Regional Stranding Coordinators ([Aleria.Jensen@noaa.gov](mailto:Aleria.Jensen@noaa.gov) and [Barabara.Mahoney@noaa.gov](mailto:Barabara.Mahoney@noaa.gov)). The report must include the same information identified in Condition 10(a) above. Activities may continue while NMFS reviews the circumstances of the incident. NMFS will work with Hilcorp to determine whether modifications in the activities are appropriate.

(c) In the event that Hilcorp discovers an injured or dead marine mammal, and the lead PSO determines that the injury or death is not associated with or related to the activities

authorized in Condition 3 of this Authorization (e.g., previously wounded animal, carcass with moderate to advanced decomposition, or scavenger damage), Hilcorp shall report the incident to the Chief, Permits and Conservation Division, Office of Protected Resources, NMFS, at 301-427-8401, and/or by email to [Jolie.Harrison@noaa.gov](mailto:Jolie.Harrison@noaa.gov) and [Shane.Guan@noaa.gov](mailto:Shane.Guan@noaa.gov) and the NMFS Alaska Stranding Hotline (1-877-925-7773) and/or by email to the Alaska Regional Stranding Coordinators ([Aleria.Jensen@noaa.gov](mailto:Aleria.Jensen@noaa.gov) and [Barbara.Mahoney@noaa.gov](mailto:Barbara.Mahoney@noaa.gov)), within 24 hours of the discovery. Hilcorp shall provide photographs or video footage (if available) or other documentation of the stranded animal sighting to NMFS and the Marine Mammal Stranding Network. Hilcorp can continue its operations under such a case.

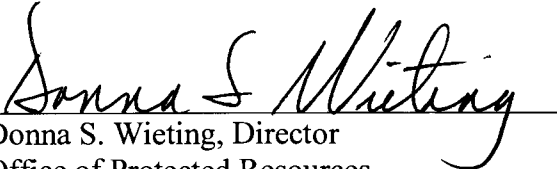
11. Activities related to the monitoring described in this Authorization do not require a separate scientific research permit issued under section 104 of the Marine Mammal Protection Act.

12. The Plan of Cooperation outlining the steps that will be taken to cooperate and communicate with the native communities to ensure the availability of marine mammals for subsistence uses, must be implemented.

13. This Authorization may be modified, suspended, or withdrawn if the holder fails to abide by the conditions prescribed herein or if the authorized taking is having more than a negligible impact on the species or stock of affected marine mammals, or if there is an unmitigable adverse impact on the availability of such species or stocks for subsistence uses.

14. A copy of this Authorization and the Incidental Take Statement must be in the possession of each survey vessel operator taking marine mammals under the authority of this Incidental Harassment Authorization.

15. Hilcorp is required to comply with the Terms and Conditions of the Incidental Take Statement corresponding to NMFS' Biological Opinion.

  
Donna S. Wieting, Director  
Office of Protected Resources  
National Marine Fisheries Service

JUN 29 2015

Date

Attachment

**Table 1. Species and numbers of marine mammals allowed to be taken incidental to activities conducted under this IHA.**

<b>Species</b>	<b>Authorized Level B Take</b>
Beluga whale (Beaufort Sea stock)	45
Bowhead whale	9
Gray whale	3
Bearded seal	87
Ringed seal	324
Spotted seal	103



IN REPLY REFER TO:

# United States Department of the Interior

U.S. FISH AND WILDLIFE SERVICE  
1011 East Tudor Road  
Anchorage, Alaska 99503-6199



AFES/MMM

JAN 29 2015

Mr. William G. Britt, Jr.  
Environment Manager  
Hilcorp Alaska, LLC  
3800 Centerpoint Drive, Suite 1400  
Anchorage, Alaska 99503

Dear Mr. Britt:

We have received your request, dated November 25, 2014, for Letters of Authorizations (LOAs) for the incidental take of polar bears and Pacific walrus and the intentional take of polar bears in regards to the Hilcorp Alaska, LLC (Hilcorp) 2015 Liberty Development Geotechnical and Shallow Hazard Survey on the North Slope of Alaska.

In response, and in accordance with regulations listed at 76 FR 47010, dated August 3, 2011, enclosed is LOA 15-08 authorizing Hilcorp to take small numbers of polar bears and Pacific walrus incidental to oil and gas exploration activities in association with the 2015 Liberty Development Geotechnical and Shallow Hazard Survey on the North Slope of Alaska. In addition, Intentional Take Authorization LOA 15-INT-08, as authorized under sections 101(a)(4)(A), 109(h), and 112(c) of the Marine Mammal Protection Act (MMPA), is also enclosed.

Hilcorp proposes to conduct a geotechnical investigation, shallow hazard sonar survey and strudel scour survey with a transition zone component on state lands, and in federal and state waters of Foggy Island Bay in the Beaufort Sea during the winter, spring break-up and open water seasons of 2015. A detailed description of the proposed activities is provided in Hilcorp's *Request for Letter of Authorization (LOA) for the Incidental Take of Polar Bears and Pacific Walrus, Intentional Take of Polar Bears by Harassment; Liberty Development Geotechnical and Shallow Hazard Survey, North Slope, Alaska dated November 25, 2014.*

All provisions contained within Hilcorp's *ATTACHMENT V, Polar Bear and Walrus Interaction and Mitigation Plan* are incorporated by reference into this LOA. Hilcorp field camps and personnel shall limit encounters of polar bears by being observant of approaching animals (i.e., the use of polar bear guards) and where practicable, by allowing the animals to pass unhindered. Hilcorp must also: 1) Provide copies of the polar bear observation form to all contractors operating under the LOA; 2) report any walrus or polar bear sightings, or signs of polar bears,

Mr. William G. Britt, Jr.

2

such as tracks or excavations, to our office using the polar bear observation report; and, 3) report any possible den locations that are found during work activities immediately to our office. Service biologists are available for consultation if questions or concerns arise during the project period at the phone number listed below and noted in your interaction plan.

If a polar bear interaction escalates into a life threatening situation, section 101(c) of the MMPA allows, without specific authorization, the take (including lethal take) of a polar bear if such taking is imminently necessary for self-defense or to save the life of a person in immediate danger, and such taking is reported to the Service within 24 hours.

Polar bear conservation has benefited from monitoring programs associated with the Incidental Take Program since 1993. Monitoring serves to assess the effect of industrial activities on polar bears by evaluating trends and effects of bear encounter rates, take frequency, as well as the location and timing of encounters. Additionally, through monitoring, the Service seeks to limit disturbance to maternal polar bear den sites, both known dens and those areas that could be preferred by denning polar bears. Hilcorp must use caution when operating near these areas during the maternal denning period (mid-November to mid-April). A polar bear den detection survey will be required in areas of potential denning habitat where Hilcorp proposes to operate.

The U.S. Geological Survey has posted information regarding polar bear denning habitat on the Alaska Science Center (ASC) website. The den habitat map (ARC/INFO export file), the mapping manuscript (PDF file), and a picture of den habitat (JPG file) are available on the ASC website: <http://www.absc.usgs.gov/dataproducts.htm>. Use these resources when planning activities in potential denning areas.

If any changes develop during the project, such as activities or location, the Service must be notified prior to the planned operation. This will allow us to evaluate the activity and, if appropriate, amend the appropriate LOA(s).

The Service has completed intra-Service consultation under the Endangered Species Act of 1973, as amended (ESA), on the issuance of these LOAs and has determined that the issuance these LOAs is not likely to jeopardize the continuing existence of polar bears. No additional authorization under the ESA is required.

If you have any further questions, please contact Mr. Christopher Putnam of our Marine Mammals Management Office at (907) 786-3844.

Sincerely,  
  
Chief, Marine Mammals Management

Enclosures

Mr. William G. Britt, Jr.

3

cc: Mr. Richard Shideler, Alaska Department of Fish and Game (Email)  
U.S. Fish and Wildlife Service, Fairbanks Fish and Wildlife Field Office (Email)  
U.S. Fish and Wildlife Service, Office of Law Enforcement (Email)  
North Slope Borough, Department of Law (Email)







IN REPLY REFER TO:

# United States Department of the Interior

U.S. FISH AND WILDLIFE SERVICE  
1011 East Tudor Road  
Anchorage, Alaska 99503-6199



AFES/MMM

JAN 29 2015

## LETTER OF AUTHORIZATION Incidental Take (15-08)

ISSUED: February 1, 2015  
EXPIRES: February 1, 2016

Hilcorp Alaska, LLC (Hilcorp) is hereby authorized to take small numbers of polar bears (*Ursus maritimus*) and Pacific walrus (*Odobenus rosmarus divergens*) incidental to activities occurring during the 2015 Liberty Development Geotechnical and Shallow Hazard Survey on the North Slope of Alaska.

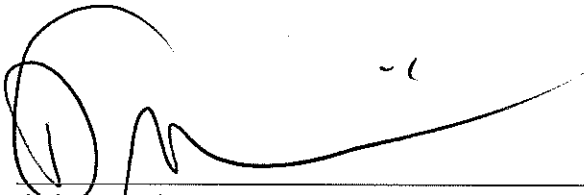
Hilcorp proposes to conduct a geotechnical investigation, shallow hazard sonar survey and strudel scour survey with a transition zone component on state lands, and in federal and state waters of Foggy Island Bay in the Beaufort Sea during the winter, spring break-up and open water seasons of 2015. A detailed description of the proposed activities is provided in Hilcorp's *Request for Letter of Authorization (LOA) for the Incidental Take of Polar Bears and Pacific Walrus, Intentional Take of Polar Bears by Harassment; Liberty Development Geotechnical and Shallow Hazard Survey, North Slope, Alaska dated November 25, 2014.*

This Letter of Authorization (LOA) and the required conditions below apply to all Hilcorp employees, contractors and personnel performing Hilcorp-approved work under the scope of operations to be conducted. This authorization is subject to the following conditions.

1. Only incidental take is authorized under this LOA.
2. Hilcorp's *ATTACHMENT V, Polar Bear and Walrus Interaction and Mitigation Plan* is approved and all provisions must be complied with unless specifically noted otherwise in this LOA.
3. A copy of this LOA and the approved interaction plan listed above must be posted and available for all personnel and in the possession of the operators of all vessels and aircraft engaging in the activities approved under the authority of this LOA.
4. Hilcorp Operations Managers, or designates, must be fully aware, understand, and be capable of implementing the conditions of this LOA.

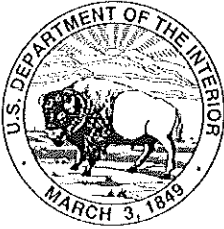
5. At the discretion of the U.S. Fish and Wildlife service (Service), Hilcorp must allow the Service to place an observer on site, including any facilities, vessels, aircraft, or vehicles, to monitor the impacts of the activity on marine mammals, when requested.
6. Monitoring, mitigation, and reporting activities will be conducted in accordance with 50 CFR § 18.128 and must comply with the following requirements:
  - Hilcorp must cooperate with the Service, and other designated Federal, State, or local agencies to monitor the impacts of oil and gas exploration activities on polar bears and walrus.
  - If any changes develop in the project during the period approved under this LOA, such as activities, location, or methods, Hilcorp must notify the Service, Marine Mammals Management Office (MMM) prior to the implementation of such changes.
  - A polar bear den detection survey will be required each year in the areas of potential denning habitat where Hilcorp proposes to operate. Hilcorp completed a den detection survey in December, 2014.
  - Hilcorp must not conduct activities that operate nor pass within one mile (1.6 kilometers) of known polar bear dens, and all observed dens must be reported to the Service, MMM within 12 hours of discovery. If occupied dens are identified within one mile of activities, work within the immediate area will cease and the Service must be contacted for guidance. The Service will evaluate these instances on a case-by-case basis to determine the appropriate action. Potential actions may range from cessation or modification of work to conducting additional monitoring. Hilcorp must comply with any additional measures specified.
  - Operators of support aircraft should, at all times, conduct their activities at the maximum distance possible from concentrations of walrus or polar bears.
  - Under no circumstances, other than an emergency, should fixed wing aircraft operate at an altitude lower than 457 m (1,500 feet [ft]) within 805 m (0.5 mi) of walrus groups observed on ice, or within 1,610 m (1 mi) of walrus groups observed on land. Under no circumstances, other than an emergency, should rotary winged aircraft (helicopters) operate at an altitude lower than 914 m (3,000 ft) within 1,610 m (1 mi) of walrus groups observed on land. Under no circumstances, other than an emergency, should aircraft operate at an altitude lower than 457 m (1,500 ft) within 805 m (0.5 mi) of polar bears observed on ice or land. Helicopters may not hover or circle above such areas or within 805 m (0.5 mi) of such areas. When weather conditions do not allow a 457-m (1,500-ft) flying altitude, such as during severe storms or when cloud cover is low, aircraft may be operated below the required altitudes stipulated above. However, when aircraft are operated at altitudes below 457 m (1,500 ft) because of weather conditions, the operator must avoid areas of known walrus and polar bear concentrations and should take precautions to avoid flying directly over or within 805 m (0.5 mi) of these areas.

- Hilcorp must designate a qualified individual or individuals to observe, record, and report the effects of the activity on polar bears and walruses to the Service within 24 hours of visual observation.
- Hilcorp must submit an annual monitoring report to the Service, MMM as required under 50 CFR § 18.128, which will be received no later than 90 days after the expiration date of the LOA.

  
\_\_\_\_\_  
Chief, Marine Mammals Management

11/29/15  
\_\_\_\_\_  
Date





IN REPLY REFER TO:

# United States Department of the Interior

U.S. FISH AND WILDLIFE SERVICE  
1011 East Tudor Road  
Anchorage, Alaska 99503-6199



AFES/MMM

JAN 29 2015

## LETTER OF AUTHORIZATION Intentional Take (15-INT-05)

ISSUED: February 1, 2015  
EXPIRES: February 1, 2016

Hilcorp Alaska, LLC (Hilcorp) is hereby authorized to intentionally take by Level B non-lethal harassment, or deterrence, small numbers of polar bears (*Ursus maritimus*) associated with activities occurring during the 2015 Liberty Development Geotechnical and Shallow Hazard Survey on the North Slope of Alaska in accordance with sections 101(a)(4)(A), 109(h) and 112(c) of the Marine Mammal Protection Act of 1972 (MMPA), as amended.

Hilcorp proposes to conduct a geotechnical investigation, shallow hazard sonar survey and strudel scour survey with a transition zone component on state lands, and in federal and state waters of Foggy Island Bay in the Beaufort Sea during the winter, spring break-up and open water seasons of 2015. A detailed description of the proposed activities is provided in Hilcorp's *Request for Letter of Authorization (LOA) for the Incidental Take of Polar Bears and Pacific Walrus, Intentional Take of Polar Bears by Harassment; Liberty Development Geotechnical and Shallow Hazard Survey, North Slope, Alaska dated November 25, 2014*.

Section 101(a)(4)(A) of the MMPA states that, "Except as provided in subparagraphs (B) and (C), the provisions of this chapter shall not apply to the use of measures-

- i. by the owner of fishing gear or catch, or an employee or agent of such owner, to deter a marine mammal from damaging the gear or catch;
- ii. by the owner of other private property, or an agent, bailee, or employee of such owner, to deter a marine mammal from damaging private property;
- iii. by any person, to deter a marine mammal from endangering personal safety; or
- iv. by a government employee, to deter a marine mammal from damaging public property, so long as such measures do not result in the death or serious injury of a marine mammal."

Section 112(c) allows for the transfer of Federal authority "... as may be necessary to carry out the purposes of this title (Conservation and Protection of Marine Mammals)... and on such terms

as he deems appropriate with any Federal or State agency, public or private institution, or other person.”

Section 109(h)(1) states that, “nothing in this title [Conservation and Protection of Marine Mammals]... shall prevent a Federal, State, or local government official or employee or a person designated under section 112(c) from taking, in the course of his or her duties as an official, employee, or designee, a marine mammal in a humane manner (including euthanasia) if such taking is for-

- A. the protection or welfare of the mammal,
- B. the protection of the public health and welfare, or
- C. the non-lethal removal of nuisance animals.”

The purpose of authorizing taking by Level B non-lethal harassment, or deterrence, is to maintain human and bear safety and welfare in polar bear habitat. Authorizing Level B harassment take reduces the likelihood of death or injury of polar bears. This is accomplished by the following objectives:

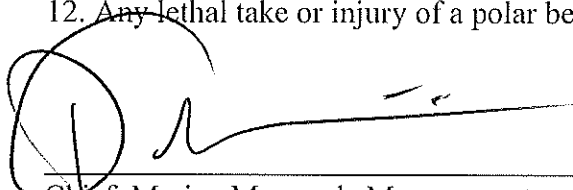
- Prevent bears from associating food with humans and facilities.
- “Teach” bears to avoid people.
- Allow bears to use travel routes (natural and human made) to move along the coast.
- Prevent bears from extended use of areas around facilities.

This Letter of Authorization (LOA) is subject to the following conditions:

1. This LOA is restricted to Level B non-lethal harassment or deterrent activities.
2. Hilcorp’s *ATTACHMENT V, Polar Bear and Walrus Interaction and Mitigation Plan* is approved and all provisions must be complied with unless specifically noted otherwise in this LOA. A copy of this interaction plan must be available on site for all personnel.
3. Hilcorp operations managers, or designates, must be fully aware, understand, and be capable of implementing the conditions of this authorization.
4. This LOA is issued specifically to Hilcorp who is responsible for ensuring **trained and qualified** personnel are assigned the task to harass (deter) polar bears. A list of trained personnel responsible for deterrence will be on file prior to initiation of activities with the Service Incidental Take Coordinator.
5. Hilcorp is solely responsible for ensuring that personnel operating under this authorization meet all Federal and State laws and regulations regarding the use and carry of firearms should firearms be used for bear deterrence.

6. Hilcorp, or its designated agent, is responsible for documenting and reporting to the U.S. Fish and Wildlife Service (Service), Marine Mammals Management Office (MMM) all instances involving harassment activities as soon as possible and no later than 24 hours after the occurrence.
7. Harassment or deterrence techniques must not cause injury or death of a bear. Types of harassment or deterrence techniques may include, but are not limited to:
  - Bear monitors.
  - Air horns.
  - Electric fences.
  - Chemical repellents.
  - Acoustic recordings.
  - Vehicles.
  - Projectiles, such as, cracker shells, bean bags, rubber bullets, and screamers.
8. Prior to conducting a harassment activity, operators must:
  - Make a reasonable effort to reduce or eliminate attractants.
  - Secure site, notify supervisor and move personnel to safety.
  - Ensure bear has escape route(s).
  - Ensure communication with all personnel.
9. When conducting a harassment activity, operators must:
  - Keep in mind that the safety and welfare of the bear is second only to the safety and welfare of humans in a harassment or deterrence situation.
  - Chose the method that will have the least effect on the bear and increase the intensity of the method or use additional methods only if necessary.
  - Shout at the bear before using projectiles or other methods.
  - Move bear in proper direction; continue with minimally necessary deterrents to receive desired result.
10. After a harassment event has occurred, operators must:
  - Monitor bears movement (to ensure no return).
  - Notify supervisor and personnel when it is safe to resume work.
  - Fill out report to be sent to the Service as required above (within 24 hours).
11. A final report of all encounters and harassment or deterrence events will be submitted to the Service, MMM no later than 60 days from the expiration date of this authorization.

12. Any lethal take or injury of a polar bear must be reported to the Service immediately.

  
\_\_\_\_\_  
Chief, Marine Mammals Management

11/29/15  
\_\_\_\_\_  
Date



## **Appendix C**

### **Sighting Table**



**Table C-1. Summary of all sightings observed by protected species observers from the M/V *Journey* during Hilcorp's shallow geohazard survey in Foggy Island Bay, 9-19 July 2015.**

Sighting no.	Date <sup>1</sup>	Species <sup>2</sup>	No. of animals <sup>3</sup>	Behavior <sup>4</sup>	Reaction <sup>5</sup>	CPA <sup>6</sup> (m)	CPA position relative to vessel <sup>7</sup>	Vessel activity <sup>8</sup>	Source type <sup>9</sup>
1	7/11/2015	Ringed seal	1	Swim	None	70	7:00	Inactive	None
2	7/13/2015	Beluga whale	1	Swim	None	135	9:30	Line shooting	Other
3	7/13/2015	Beluga whale	1	Swim	None	120	9:00	Line shooting	Other
4	7/13/2015	Beluga whale	1	Swim	None	150	11:00	Line shooting	Other
5	7/13/2015	Ringed seal	1	Swim	None	100	2:00	Line shooting	Other
6	7/14/2015	Beluga whale	1	Swim	None	400	12:00	Line shooting	Other
7	7/14/2015	Beluga whale	1	Swim	None	780	11:00	Line shooting	Other
8	7/14/2015	Unid. seal	1	Swim	None	108	7:00	Line shooting	Other
9	7/15/2015	Unid. seal	1	Swim	None	430	12:00	Line shooting	Sub-bottom profiler
10	7/16/2015	Unid. seal	1	Swim	None	75	9:00	Transit	None
11	7/16/2015	Spotted seal	1	Look	Look	30	3:00	Transit	None
12	7/17/2015	Ringed seal	1	Swim	Look	60	12:00	Line shooting-shut down	Sub-bottom profiler
13	7/17/2015	Spotted seal	1	Look	Look	150	1:30	Transit	None
14	7/17/2015	Ringed seal	1	Look	Look	54	9:00	Transit	None
15	7/18/2015	Unid. seal	1	Look	Look	150	1:00	Line shooting	Other
16	7/18/2015	Spotted seal	3	Swim away	Look	75	1:00	Transit	None
17	7/18/2015	Unid. seal	1	Swim	Look	75	12:00	Line shooting	Other
18	7/18/2015	Spotted seal	1	Swim	None	135	6:30	Line shooting	Other
19	7/18/2015	Unid. seal	1	Swim	None	200	9:00	Line shooting	Other
20	7/18/2015	Unid. seal	1	Look	Look	227	2:00	Transit	None
21	7/18/2015	Spotted seal	1	Look	Look	297	9:00	Line shooting	Other
22	7/18/2015	Unid. seal	1	Look	None	350	11:00	Line shooting	Other
23	7/19/2015	Spotted seal	2	Swim	Look	50	1:00	Line shooting-shut down	Sub-bottom profiler
24	7/19/2015	Unid. seal	1	Swim	None	250	12:00	Line shooting	Other
25	7/19/2015	Unid. seal	1	Swim	None	250	9:00	Ramp Up	Sub-bottom profiler
26	7/19/2015	Spotted seal	1	Swim	None	30	1:00	Line shooting-shut down	Sub-bottom profiler
27	7/19/2015	Unid. seal	1	Swim	None	430	6:30	Deploying gear	None

<sup>1</sup>Date in Alaska Daylight time zone.

<sup>2</sup>Species identified by trained protected species observers. Unid. = Unidentified.

<sup>3</sup>Number of individual animals observed during each sighting. No juveniles were identified during the survey.

<sup>4</sup>Behavior of animal at initial time of sighting. Look = look at vessel.

<sup>5</sup>Initial reaction of sighting. Look = look at vessel.

<sup>6</sup>CPA = Closest point of approach to the observers aboard the M/V *Journey*.

<sup>7</sup>Initial position of marine mammal relative to the vessel, where 12:00 is the bow and 06:00 is the stern.

<sup>8</sup>Vessel activity at time of sighting. Mitigation (shut down) was initiated immediately if the marine mammal was observed within or

<sup>9</sup>Active sound source at time of sighting. "Other" indicates source that is outside of audible range of marine mammals.



## **Appendix D**

### **Vessel Specifications**



# Journey

- 48' X 16' Aluminum Landing Craft
- USCG Inspected for 17 passengers
- 2005 Build Aluminum monohull
- Twin 660hp QSM-11 Cummins Engines
- Twin 365 Hamilton Jets/ twin disc transmissions
- 120V 5 KW Onan Generator
- Davitt w/ hydraulic pot puller
- 300 mile range/ 450 gallons Fuel
- sleeps 6, 4 individual bunks
- cargo deck dimensions- 18.5' X 13' X 10'
- Aft deck







Twin 660 hp QSM-11  
Cummins Engines, with  
365 Hamilton Jets, Twin  
disk transmissions







Journey



## **Appendix E**

### **Beaufort sea state Definitions**



### Beaufort Sea State (Wind Force)

Beaufort Wind Force	Wind (knots)	Wind (mph)	WMO Classification	Conditions on the Water
<b>0</b>	< 1	0-1	Calm	Sea surface smooth and mirror-like
<b>1</b>	1-3	1-3	Light Air	Scaly ripples, no foam crests
<b>2</b>	4-6	4-7	Light Breeze	Small wavelets, crests glassy, no breaking
<b>3</b>	7-10	8-12	Gentle Breeze	Large wavelets, crests begin to break, scattered whitecaps
<b>4</b>	11-16	13-18	Moderate Breeze	Small waves 1-4 ft becoming longer, numerous whitecaps
<b>5</b>	17-21	19-24	Fresh Breeze	Moderate waves 4-8 ft taking longer form, many whitecaps, some spray
<b>6</b>	22-27	25-31	Strong Breeze	Larger waves 8-13 ft, whitecaps common, more spray
<b>7</b>	28-33	32-38	Near Gale	Sea heaps up, waves 13-19 feet, white foam streaks off breakers
<b>8</b>	34-40	39-46	Gale	Moderately high (18-25 ft) waves of greater length, edges of crests begin to break into spindrift, foam blown in streaks
<b>9</b>	41-47	47-54	Strong Gale	High waves (23-32 ft), sea begins to roll, dense streaks of foam, spray may reduce visibility
<b>10</b>	48-55	55-63	Storm	Very high waves (29-41 ft) with overhanging crests, sea white with densely blown foam, heave rolling, lowered visibility
<b>11</b>	56-63	64-72	Violent Storm	Exceptionally high (37-52 ft) waves, foam patches cover sea, visibility more reduced
<b>12</b>	64 +	73-83	Hurricane	Air filled with foam, waves over 45 ft, sea completely white with driving spray, visibility greatly reduced

<http://www.spc.noaa.gov/faq/tornado/beaufort.html>

